

A TAXONOMIC STUDY OF THE
GENUS ABEDUS STÅL
(Hemiptera, Belostomatidae)

BY
ARNOLD S. MENKE

UNIVERSITY OF CALIFORNIA PUBLICATIONS IN ENTOMOLOGY

Volume 16, No. 8, pp. 393-440, plates 56-58, 44 figures in text

UNIVERSITY OF CALIFORNIA PRESS
BERKELEY AND LOS ANGELES
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EDITORS (BERKELEY): E. G. LINSLEY, R. F. SMITH, E. A. STEINHAUS, R. L. USINGER

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Submitted by editors November 30, 1959

Issued November 15, 1960

Price, \$1.00

UNIVERSITY OF CALIFORNIA PRESS
BERKELEY AND LOS ANGELES
CALIFORNIA

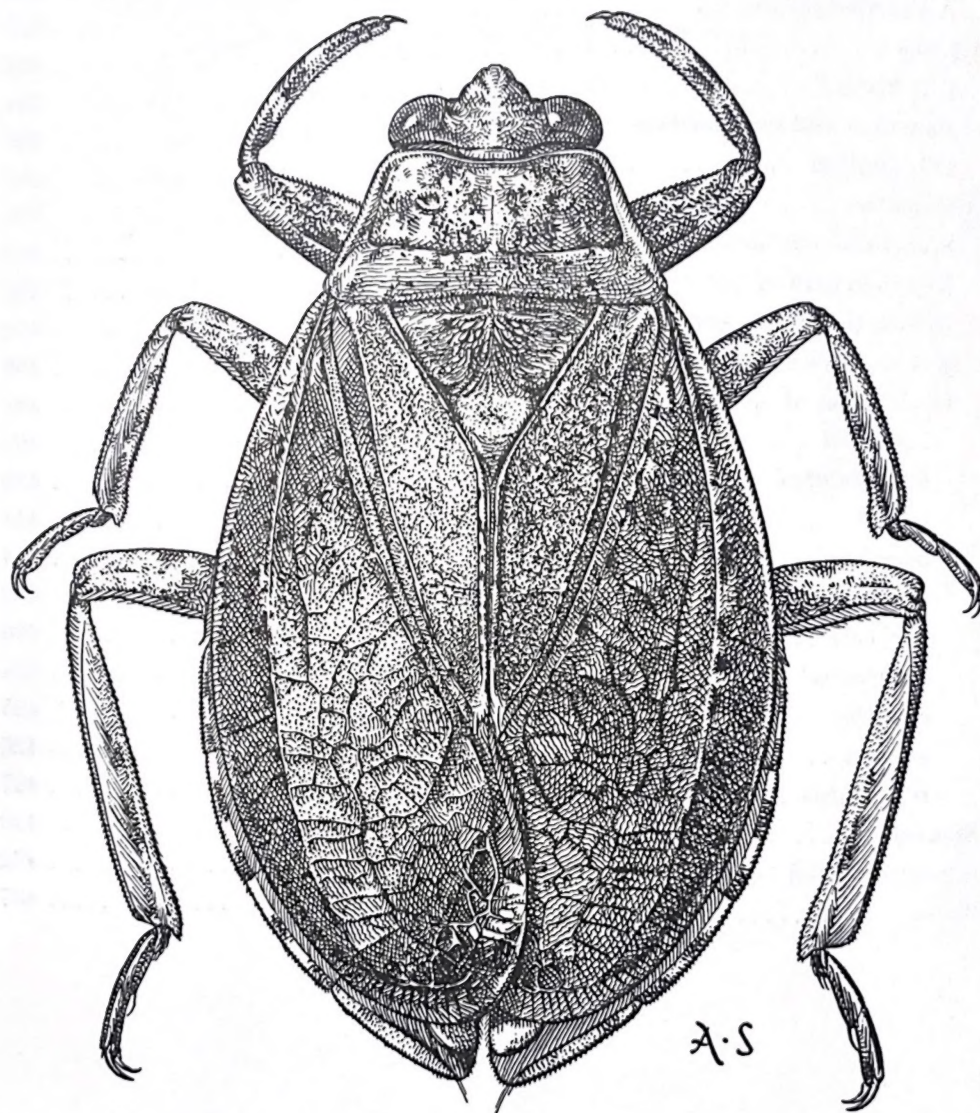


CAMBRIDGE UNIVERSITY PRESS
LONDON, ENGLAND

PRINTED IN THE UNITED STATES OF AMERICA

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Abedus indentatus (Haldeman)

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INTRODUCTION

THE GENUS *Abedus* has been revised twice in the last twenty-five years. The first revision was by Hidalgo in 1935 and the second by De Carlo in 1948. It might be assumed that the genus is in good taxonomic order, but this does not seem to be so. These true bugs are quite similar in general facies and offer little in the way of good morphological characters. Furthermore, Hidalgo and De Carlo were handicapped in their studies by insufficient material and were not aware that many of the characters which they used to delimit species are too variable to be trustworthy. Although De Carlo recognized fourteen species, I have reduced the number to ten, including three species which are described as new.

ACKNOWLEDGMENTS

My appreciation is offered to Dr. Richard M. Bohart of the University of California, Davis, for his many suggestions and helpful criticism. I also thank Dr. Robert L. Usinger of the University of California, Berkeley, for advice on various aspects of this project and for aid in obtaining type specimens located in Europe. Dr. Usinger made valuable notes on *Abedus* material in the museums at Stockholm and Vienna.

I am indebted also to Dr. Paul D. Hurd, University of California, Berkeley, and Dr. Milton A. Miller, University of California, Davis, for reading the manuscript, and to Mr. Lionel A. Stange, University of California, Davis, for collecting much of the material. Dr. Luciano Campos and Mr. Fred Iltis assisted me with a life history study.

I wish to thank the following persons who facilitated the loan of type specimens: Dr. Eric Kjellander and Dr. Lars Brundin, Stockholm Naturhistoriska Riksmuseet; Dr. H. B. Hungerford and Dr. George Byers, Snow Entomological Collections, University of Kansas; Dr. Carl J. Drake, U. S. National Museum; and Dr. Jose A. De Carlo, Museo Argentino de Ciencias Naturales.

More than 1,600 specimens of *Abedus* have been examined as a result of the coöperation of the curators of many institutions and private collections, including the following (abbreviations used subsequently for these collections are indicated in parentheses): Academy of Natural Sciences of Philadelphia (ANSP); American Museum of Natural History (AMNH); California Academy of Sciences (CAS); California Insect Survey (part of this material was obtained through the auspices of the Associates in Tropical Biogeography) (CIS); Hancock Foundation, University of Southern California (Hancock); Los Angeles County Museum (LACM); Pomona College (Pomona); San Diego Natural History Museum

(SDM); Stockholm Naturhistoriska Riksmuseet (Stockholm); Texas Agricultural and Mechanical College (TAM); Texas Technological College (TTC); University of Arizona (UA); University of California, Davis (UCD); University of Connecticut (UC); University of Kansas, Snow Entomological Collections (UK); University of Michigan Museum of Zoology (UMMZ); University of Nevada (UN); University of Utah; U. S. National Museum (USNM); Carl J. Drake Collection (CJD); Roland F. Hussey Collection (RFH); David R. Lauck Collection (DRL); E. L. Sleeper Collection (ELS); and the Robert L. Usinger Collection (RLU). Material from my own collection was also used in this study (AM).

Disposition of types and neotypes is stated for each species. Paratypes will be distributed to as many cooperating institutions and private collections as is possible.

BIOLOGY

The only publication on the biology and habits of any species of *Abedus* is that by Harvey (1907). The reader is referred to his two articles on *Pedinocoris macronyx* (= *indentatus*). Hungerford (1919) summarized Harvey's work in his excellent review of the biology and ecology of aquatic and semiaquatic Hemiptera.

I have observed all species of *Abedus* in nature with the exception of *A. decarloi* and *immaculatus*, and have studied part of the life history of *A. dilatatus*, the subject of this study unless otherwise stated.

Species of *Abedus* customarily inhabit clear, fresh-water streams and rivers. They are found occasionally in ponds or lakes but seem to prefer a stream habitat with plenty of aquatic vegetation, such as water cress (*Rorippa nasturtium-aquaticum*), where they cling to the plant near the water surface. In streams without much vegetation they are usually found hanging to the underside of rocks, in areas of riffles. *Abedus* are strong swimmers but are seldom seen swimming. They seem to prefer to wait for prey to come floating by rather than to search actively for food.

Abedus are predaceous, have voracious appetites, and feed on nearly anything they can subdue, including insects and other aquatic invertebrates, small fish, and tadpoles.

LIFE HISTORY

Eggs.—The eggs are invariably laid on the dorsum of the males as in other species of the genus (pl. 56). The first eggs laid are placed on the apex of the hemelytra, and held in place by an adhesive secreted by the female. As many as 100 eggs may be laid on the back of one male. Harvey reported 175 eggs laid on the back of one male *indentatus*. The eggs are not always laid at one time and may be from more than one female. Some males carry eggs in various stages of maturity. To determine whether a female requires a male of her own species as an egg deposition site, I placed a gravid female *indentatus* with a male *dilatatus* and in a few days found eggs on the male's back. This suggests that apparently the female may pick a male of any species for egg deposition if one of her own is not available. As far as I can determine, no one has observed eggs on the back of a female of any species.

The egg when laid is about 2.5 mm. in length but expands to about 4 mm. just before hatching. As the egg matures, a whitish "cap" forms at the apex and the

black eyes of the contained bug can be seen. The total period of incubation is unknown to me. I collected males with what seemed to be newly laid eggs at Nombre de Dios, Durango, Mexico, on December 24, 1958. On January 25, 1959, the first nymphs were seen hatching from the eggs, and by January 27 eclosion was complete.

Nymphs.—The first instar nymphs are about 7.5 mm. in length. They were fed mosquito larvae and adults, both of which were eaten readily by the young nymphs. The young bugs were very alert and would grab immediately at anything moving at the water surface near them. This stage lasted from 19 to 24 days.

The second instar nymphs were first observed on February 13 and were about 10.5 mm. long. These, too, were fed mosquito immatures. This stage lasted from 16 to 20 days.

Third instar nymphs were first seen on March 1, when they were about 13.5 mm. in length. They were fed back swimmers (*Buenoa scimitra*). This stage lasted 10 to 14 days.

On March 11 fourth instars were observed. They measured about 18.5 mm. in length and were fed a variety of food including back swimmers, damselfly naiads, and May-fly nymphs. This stage lasted 13 days.

A single fifth instar nymph appeared on March 24. It measured 25 mm. in length and was fed a variety of insects but died after a meal of termites. The total length of the nymphal period is not known but is presumed to be in excess of 10 weeks at room temperatures. The duration of each instar is probably very flexible and may depend on the quantity of available food.

Ecdysis.—Ecdysis was observed frequently. Just before molting, the bug becomes quite bloated or distended dorsoventrally, especially in the thoracic region. The act of shedding occurs while the bug is floating, legs spread, at the surface. The skin breaks first along the mid-line of the mesothoracic dorsum. This fracture proceeds both posteriorly to the first abdominal segment and anteriorly to the ecdysial suture of the head. During the process the gut is in a state of peristalsis. The contractions proceed forward to the thorax and may exert pressure on the body fluid to help swell that region and thus aid in the process of ecdysis. Nine minutes after the process starts the bug is essentially out of the old skin. Only the last two or three abdominal segments remain inside. The bug rests in this condition for a few moments, then kicks off the skin, and takes a supply of air at the surface. The entire process takes about 14 minutes. The newly emerged nymph is white but soon darkens.

PARASITES AND COMMENSALS

Several kinds of organisms have been found associated with *Abedus*. Colonial protozoa of the family Vorticellidae are frequently found growing on them. The colonies may become quite large and conspicuous, but they seem to be harmless to the bug and are probably only using it as a place of attachment. Leeches (Hirudinea) have been observed on *Abedus indentatus* collected at Onyx, Kern County, California. Large numbers of leeches of the genus *Helobdella* were found clinging to several bugs. The leeches had many young under their bodies and may have been using the water bugs only as a reproductive site. *Abedus* frequently are

captured with saclike larval mites (Acarina) attached to parts of the body. These probably are truly parasitic, deriving their food from the blood of the host.

DISTRIBUTION

The genus is found only in the Western Hemisphere north of and including the Isthmus of Panama. The range extends north to about 39° latitude in California. It also covers southern Utah, Arizona, southern New Mexico, southern Texas, and eastward to Florida and Georgia. Cold winter temperatures probably explain its absence in more northern regions. México has the greatest number of species with eight represented there.

SYSTEMATICS

Three definite periods can be recognized in the taxonomy of the genus. The first period (1862–1871) was dominated by two workers, Carl Stål and Gustav Mayr. In 1862, Stål proposed the genus *Abedus* for his two new species, *ovatus* and *breviceps*. The most significant characters for *Abedus* were: metasternum carinate, venter of abdomen pubescent except medianly, and anterior angles of pronotum angulate. Stål also described the genus *Serphus* for Say's *Belostoma dilatata* in the same paper. This genus was separated from *Abedus* on the basis of complete abdominal pubescence and rounded anterior angles of the pronotum. Apparently unaware of Stål's work, Mayr described two new genera in 1863. He proposed one of these, *Stenoscytus*, for the new species *mexicanus*. As *mexicanus* is synonymous with *ovatus*, *Stenoscytus* becomes a synonym of *Abedus*. The other genus described by Mayr was *Pedinocoris*, which was established for the two new species, *macronyx* and *brachonyx*. *Pedinocoris* was characterized as having the metasternum not keeled. In 1871, Mayr again reviewed the family. Here he corrected some of his earlier errors, and recognized three genera: *Abedus*, *Serphus*, and *Pedinocoris*. Mayr's paper ended the first period of *Abedus* taxonomy. Nothing further of significance was contributed until 1897, except for a few papers by Uhler which included erroneous identifications and much misrepresentation of facts.

G. W. Kirkaldy and A. L. Montandon were the leading workers in the field in the second period (1897–1903). Kirkaldy made several valuable contributions by designating types of genera and by straightening out certain nomenclatorial problems. In 1897, he renamed Stål's *Serphus*, which was preoccupied by *Serphus* Schrank, 1780, as *Deinostoma*. He designated *dilatatus* as type, and in 1898 he designated *macronyx* as the type of *Pedinocoris*. Montandon wrote two essays on the status of *Abedus*, *Deinostoma*, and *Pedinocoris*. In 1900, he synonymized the three under one genus, *Abedus*. He stated that the characters used by Mayr to separate them were not of generic value. He showed that the antennal characters used by Mayr were too variable to be reliable, and he rejected the presence or absence of a carina on the metasternum as too variable. G. Champion in 1901 disagreed with Montandon's work and stated that he considered the three genera valid. Montandon in 1903 again reviewed the status of *Abedus* and decided to recognize as subgenera the three original genera of Mayr. He characterized them as follows:

Deinostoma.—Claval commissure about one and a half times the length of the

scutellum; metasternum carinate; anterior angles of pronotum rounded; first segment of beak subequal with second.

Pedinocoris.—Claval commissure subequal to length of scutellum; metasternum not carinate; anterior angles of pronotum round; first segment of beak subequal to second.

Abedus.—Claval commissure subequal to length of scutellum; metasternum carinate; anterior angles of pronotum angulate; first segment of beak longer than second.

Montandon's paper ended the second period of *Abedus* taxonomy and for nearly thirty years little was done with the genus except for biological studies by Harvey.

The third period has been dominated by Dr. Jose A. De Carlo, who first published on *Abedus* in 1932 and in 1948 presented a revision of the genus. Before reviewing De Carlo's work, notation must be made of a significant paper on *Abedus* by Hidalgo in 1935. Hidalgo revised the genus and was the first person really to bring to light certain very significant specific characters. He demonstrated the importance of the abdominal pubescence and the air straps (appendages of the 8th abdominal segment) in species definition. Unfortunately, he apparently did not critically examine the phallus (which I have found valuable in species determination), since he stated, "the genitalia do not even show group characters." Hidalgo pointed out that the antenna, metasternum, and size were of little value.

De Carlo, in his 1948 revision, used the subgeneric classification proposed by Montandon in 1903, except that he discarded the proportions of the segments of the beak as not being consistent enough to be usable. Unfortunately, De Carlo apparently ignored the facts revealed by Hidalgo, and did not use the air straps in species determination. His new species were based primarily on size, antennal characters, abdominal pubescence, and head characteristics. In 1951 De Carlo proposed a new subgeneric classification of *Abedus* after Hussey and Herring (1950) had established the subgenus *Microabedus* for *A. immaculatus*. He found that the metasternal carina was present in some species of *Pedinocoris*, and because of this inconsistency he synonymized *Pedinocoris* and *Deinostoma* under *Abedus*. Then he proposed two new subgenera based on antennal characters and abdominal pubescence. His four subgenera were as follows:

Abedus.—Antenna 3-segmented; abdomen totally or partly covered with pubescence.

Parabedus.—Antenna 4-segmented, segments II and III with a lateral prolongation; abdomen totally or partly covered with pubescence.

Pseudoabedus.—Antenna 4-segmented, segments II and III with a lateral prolongation; abdomen glabrous; only ventral laterotergites pubescent.

Microabedus.—Antenna 4-segmented, III with a short prolongation; abdomen glabrous, only ventral laterotergites pubescent.

This subgeneric classification by De Carlo is hardly acceptable in the light of what is now known. It is not a natural classification, as can be demonstrated by an examination of the species in each group. For instance, the closely related species *ovatus* and *breviceps* are placed in separate subgenera by De Carlo. The antennal characters he used are not sufficiently reliable to delimit subgenera. The number of segments varies from specimen to specimen in certain species and even

the two antennae of a single individual may differ. The secondary feature used by De Carlo to differentiate his subgenera was abdominal pubescence. This is indeed a good subgeneric character, but not as he used it.

A natural division of the genus into four subgenera is made in the following scheme:¹

Abedus (*Pseudoabedus*).—Air straps similar in both sexes, lanceolate, evenly covered with long hairs dorsally; ventral laterotergite I glabrous; pubescence of ventral laterotergites uniformly long; abdominal sternites including genital plate with scattered minute spinules, laterobasal area of plates often with longer, appressed silky hairs; metasternum strongly keeled; antenna 4-segmented, II and III bearing long fingerlike projections. Species: *signoreti*.

Abedus (*Microabedus*).—Air straps similar in both sexes, lanceolate, evenly covered with long hairs dorsally; ventral laterotergite I glabrous; appressed silky pubescence of ventral laterotergites grading into short dense spines mesally; abdominal sternites including genital plate densely covered with spinules; metasternum keeled basally, tumescent beyond; antenna 4-segmented, III bearing a short projection. Species: *immaculatus*.

Abedus (*Abedus*).—Air straps dimorphic, spatulate, bearing special transverse bands of pubescence dorsally; ventral laterotergites I–V completely and uniformly pubescent; abdominal sternites covered with silky pubescence but glabrous mesally, genital plate glabrous; metasternum strongly keeled; antenna variable, 3- or 4-segmented, II and III bearing short to long processes. Species: *ovatus* and *breviceps*.

Abedus (*Deinostoma*).—Air straps dimorphic, spatulate, bearing special transverse bands of pubescence dorsally; ventral laterotergites I–V completely and uniformly pubescent; abdominal sternites including genital plate completely covered by long, silky, appressed pubescence; metasternum keeled basally, tumescent beyond; antenna variable, 3- or 4-segmented, rarely 2-segmented, II and III bearing short to long processes. Species: *dilatatus*, *indentatus*, *herberti*, *immensus*, *decarloi*, and *stangei*.

STRUCTURAL CHARACTERS

Since reference to the characters used by previous workers has been made elsewhere, this discussion is limited to those features which I have found relatively constant.

Phallus.—This structure offers one of the best means of identification known to me. The general appearance, the shape and position of the ejaculatory duct, and the degree of development of the lateral "wings" usually present distinctive specific differences. In some cases it is necessary to use the phallus in conjunction with the air strap since some species have identical or nearly identical phalli.²

Air strap.—The air strap is perhaps the best single structure characterizing

¹ Hidalgo (1935) mentioned the grouping I have used but did not assign subgeneric status to the groups.

² In my recent paper on *Belostoma* (1958), I stated erroneously that the genitalia were not of specific value. After investigating *Abedus* I reexamined *Belostoma* and found that the phallus apparently offers excellent species characters. Dr. David R. Lauck, now working on *Belostoma*, has informed me in a letter that he has also found the phallus to be of taxonomic significance.

species. The presence or absence of sacs, ripples, and depressions combined with the pattern of hair on the dorsum is usually very distinctive for each species, especially in the males. The straps are not identical in the two sexes, especially in the species of the subgenus *Deinostoma*. In the latter case, the females of four species are very difficult to distinguish without males since the straps are so nearly alike. Hidalgo did not realize this and in his work figured the strap of the male in some cases and the female in others. When the strap is used with the phallus, identification is simplified.

Ventral abdominal and laterotergite (connexival auct.) pubescence.—The pattern of hair on the venter is characteristic for the species in the subgenera *Pseudoabedus*, *Microabedus*, and *Abedus*. In *Deinostoma* the pubescence is uniform.

Head characteristics.—The eye shape, proportions of head structures, and other morphological features are of some value, but they cannot be used with any degree of reliability because of variation. The antenna is of little specific value since it varies considerably in many of the species, even in the number of segments.

Thoracic features.—The shape and proportions of the pronotum are of value only as group characters. The prosternal carina is variable in all species. The presence or absence of a longitudinal carina on the metasternum is of importance in some of the species but is primarily a group character.

Membrane.—The width or development of the membrane is of some importance, but the female usually has a better developed membrane, and this must be considered in a diagnosis. The apex of the forewing may be rounded or slightly emarginate in some species. This, too, is variable.

General appearance and color.—Although many of the species have a rather distinctive appearance, especially to one familiar with the group, it is difficult to describe the rather subtle differences. Color and maculation of the legs and body are variable and not of much importance in any of the species.

The two sexes can easily be recognized. The male has the genital plate acutely rounded at the tip without tufts of hair. The female genital plate is somewhat truncate apically and has two tufts of hair or setae mesally near the apical margin. The embolium of the males in most species is broader, especially basally.

KEY TO THE GENERA OF WESTERN HEMISPHERE BELOSTOMATIDAE

1. Segment I of beak much longer than greatest thickness, subequal in length to segment II. 2
 Segment I of beak short, thicker than long and obviously shorter than segment II. 3
2. Greatest width of membrane and translucent margin combined more than greatest width of clavus; most cells equal in length and forming long narrow rectangles. . . *Belostoma* Latreille
 Membrane much reduced, greatest width of membrane and translucent margin combined equal to or, more commonly, less than greatest width of clavus (if greater than clavus then membrane is crescent-shaped); cells usually small or feebly defined, or short rectangular, and of various lengths. *Abedus* Stål
3. Anterior tarsus 2-segmented and bearing one long claw
 Lethocerus Mayr (includes *Benacus* Stål)^a
 Anterior tarsus 1-segmented and bearing two very short, inconspicuous claws; South America
 Horvathinia Montandon

^a *Benacus* is considered only as a subgenus of *Lethocerus* because the phallus and antennae are not generically distinct. This will be discussed in detail in a paper soon to be published.

DESCRIPTION OF THE GENUS ABEDUS

Abedus Stål

Abedus Stål,⁴ 1862, Ent. Zeitung, 23 (10-12):461. Based on two species: *ovatus* and *breviceps*. Type: *Abedus ovatus* Stål, designated by Kirkaldy, 1906.

Serphus Stål, 1862, Ent. Zeitung, 23 (10-12):462. Type: *Belostoma dilatata* Say, type by monotypy.

Stenoscytus Mayr, 1863, Verh. K. K. Zool.-Bot. Ges. Wien, 13:341, 343-347. Type: *Stenoscytus mexicanus* Mayr (= *Abedus ovatus*), type by monotypy.

Pedinocoris Mayr, 1863, Verh. K. K. Zool.-Bot. Ges. Wien, 13:341, 347-349. Based on two species: *macronyx* and *brachonyx*. Type: *Pedinocoris macronyx* (= *Zaitha indentata*), designated by Kirkaldy, 1898.

Deinostoma Kirkaldy, 1897, Entomologist, 30:258. New name for *Serphus* Stål, preoccupied by *Serphus* Schrank, 1780.

Microabedus Hussey and Herring, 1950, Fla. Ent., 33:85. Type: *Abedus cantralli* Hussey and Herring (= *Belostoma immaculata*), type by monotypy.

Parabedus De Carlo, 1951, Rev. Soc. Ent. Arg., 15:71. Proposed as a subgenus containing three species: *breviceps*, *mayri*, and *hungerfordi*. Type: *Abedus breviceps*, present designation.

Pseudoabedus De Carlo, 1951, Rev. Soc. Ent. Arg., 15:71. Proposed as a subgenus containing two species: *signoreti* and *usingeri*. Type: *Abedus signoreti*, present designation.

Oval, dorsoventrally flattened, brown bugs of medium to large size. Beak composed of 3 segments, I and II nearly equal in length and of nearly the same thickness. Antenna 2- to 4-segmented; segment II nearly always bears either a short tooth or tubercle, or a long fingerlike process; segment III may or may not bear a tooth or fingerlike process. Eye large, prominent, width about one-half interocular distance.⁵ Membrane of hemelytron reduced, linear, or crescent-shaped; cells rhomboidal, short rectangular, or more rarely obsolete. Profemur incrassate, wider than meso- or metafemur. Protarsus composed of 2 segments and terminated by a single long claw; meso- and metatarsi 3-segmented and each terminated by 2 long claws. Prosternal carina elevated, semicircular, or acuminate. Metasternum longitudinally carinate or merely elevated or swollen, and acuminate at apex. Ventral abdominal plates completely glabrous to completely covered with short pubescence; ventral laterotergites laterally with a thin glabrous margin from base of plate III to apex of plate VI. Each air strap divided into a basal stalk and an apical lobe, spatulate (except in two species). Side of phallus expanded into a long, thin, longitudinal "wing."

KEY TO THE SPECIES OF ABEDUS

(Based primarily on males⁶)

1. Air straps similar in both sexes, lanceolate, evenly covered with long hairs dorsally (figs. 1-2); ventral laterotergite I glabrous (fig. 40) 2
- Air straps dimorphic, spatulate, bearing special transverse bands of pubescence dorsally (figs. 8-15); ventral laterotergites I-V completely and uniformly pubescent (figs. 37-39) 3
2. Metasternum strongly keeled from base to apex; antenna 4-segmented, II and III bearing long fingerlike projections (fig. 3) subgenus *Pseudoabedus*... *Abedus signoreti* Mayr, s.l.
- Metasternum keeled only basally, tumescent beyond; antenna 4-segmented, III bearing a short projection (fig. 18) subgenus *Microabedus*... *Abedus immaculatus* (Say)
3. Abdominal sternites covered with silky pubescence but glabrous mesally, genital plate glabrous (figs. 38-39); metasternum strongly keeled from base to apex subgenus *Abedus* 4

⁴ The masculine noun *Abedus* is probably derived from the Latin word *edo* which means "to eat." *Abedus* can therefore be translated loosely as meaning "an eater."

⁵ The interocular distance is that part of the vertex measured along a line drawn through the widest part of the head.

⁶ Females of the subgenus *Deinostoma* are difficult to identify except through association with males.

Abdominal sternites including genital plate completely covered by long, silky, appressed pubescence (fig. 37); metasternum keeled only basally, tumescent beyond...subgenus

Deinostoma...5

4. Mesal glabrous area of abdominal plates broad, usually extending from base of plate III to apex of V (occasional specimens have a mesal bare area on plate II) (fig. 39); eye very large, globular, much higher than the interocular space (fig. 33); air strap without a dorsal sac at basal end of lobe (fig. 11, a, b).....*Abedus breviceps* Stål
Mesal glabrous area of abdominal plates narrowed toward base of abdomen, usually extending from base of plate IV to apex of plate V (occasional specimens have a mesal glabrous area on plate III) (fig. 38); eye of normal size, barely higher than interocular space (fig. 29); air strap with a dorsal sac at basal half of lobe (fig. 10, a, b).....*Abedus ovatus* Stål
5. Air strap of male and female without a dorsal circular depression on the basal half of the lobe, but covered with a tomentose pubescence, no ripple or sac present; pattern of hair on apical half of lobe forming a narrow band which may be sinuate at least at mesal margin of lobe (figs. 8-9); California, Baja California, and eastern México.....6
Air strap of male with a dorsal circular depression on basal half of lobe in which there may or may not be situated one or more longitudinal or semicircular folds or "ripples," or strap with a definite sac which may or may not be in a depression (figs. 12, a, 13, a, 14, 15, a); air strap of female without the above mentioned ripples or sac, narrow, with a broad triangular patch of hair dorsally (figs. 12, b, 13, b, 15, b).....7
6. Lateral wing of phallus long, straight basally but arching downward near apex (fig. 24); California and northern Baja California.....*Abedus indentatus* (Haldeman)
Lateral wing of phallus short, strongly arched throughout its length (fig. 27); states of Vera Cruz and Puebla, México.....*Abedus stangei* Menke, n. sp.
7. Air strap of male with or without ripples, no sac present (figs. 13, a, 14, 15, a).....8
Air strap of male with a definite sac (fig. 12, a); size large, 35 mm. or more in length; west central México.....*Abedus immensus* Menke, n. sp.
8. Patch of hair on apical half of lobe of male strap broadest near mesal margin and tapering to a point toward lateral margin, triangular (figs. 13, a, 14).....9
Patch of hair on apical half of lobe of male strap broadest along lateral margin and narrowing toward mesal margin (fig. 15, a); lateral wing of phallus arched throughout its length (fig. 28); average size about 29 mm. in length; central plateau of México
Abedus dilatatus (Say)
9. Phallus broadened laterally at apex, lateral wing well developed apically (figs. 24, 34); appearance of air strap of male as in figure 13, a (without ripples in one subspecies); southern Utah, Arizona, New Mexico, and northern México.....*Abedus herberti* Hidalgo, s.l.
Phallus not conspicuously broadened laterally at apex, lateral wing not well developed apically (figs. 17, 36); air strap of male as in figure 14; state of Nayarit, México
Abedus decarloi Menke, n. sp.

DESCRIPTION OF SPECIES

Abedus (Pseudoabedus) signoreti Mayr, sensu lato

(Figs. 2, 3, 23, 32, 42)

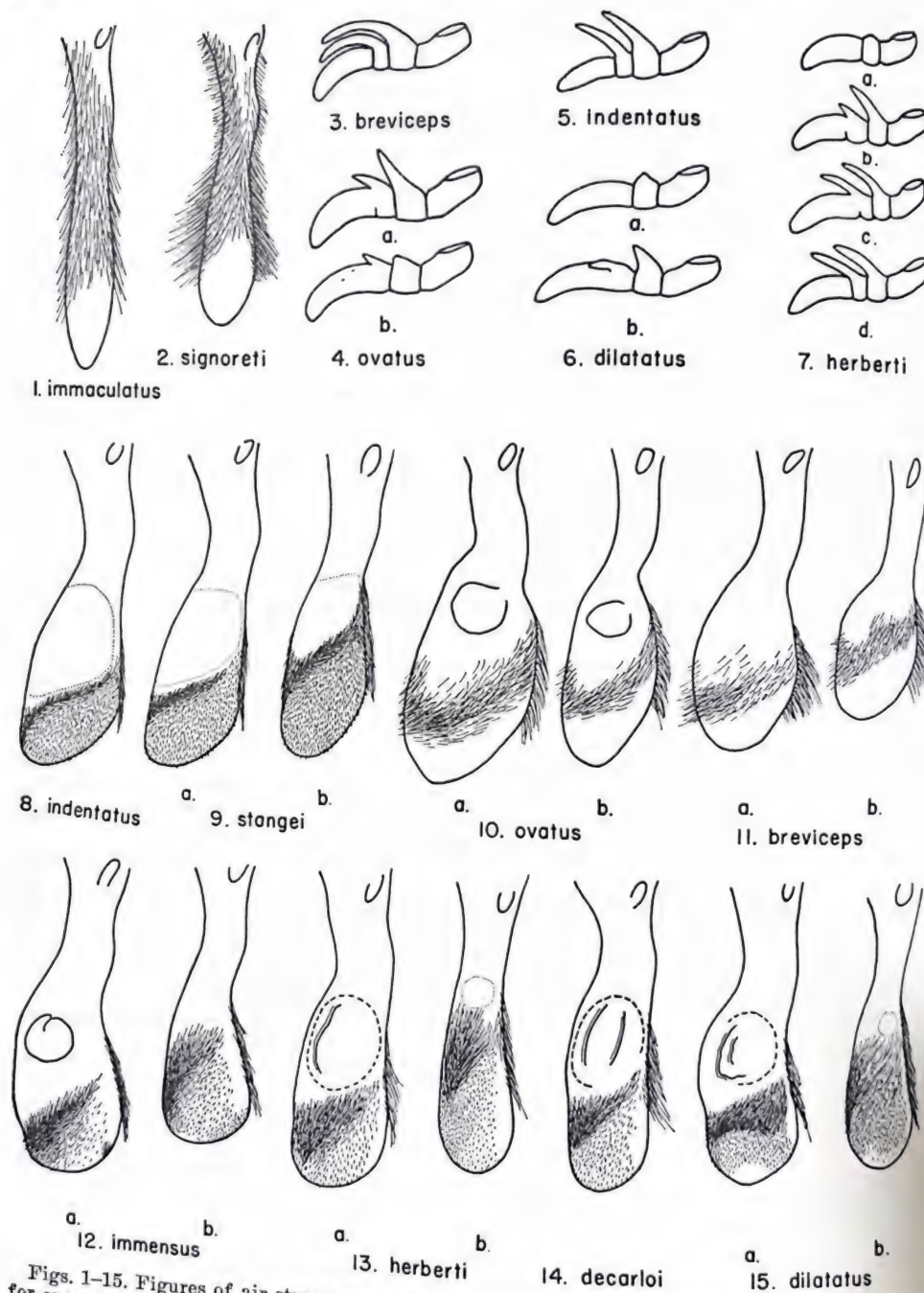
This is the most variable species in the genus and can be divided into three subspecies. The following description will serve to define the species:

Size: Length, 20.5-29 mm.; width, 11.5-16 mm.

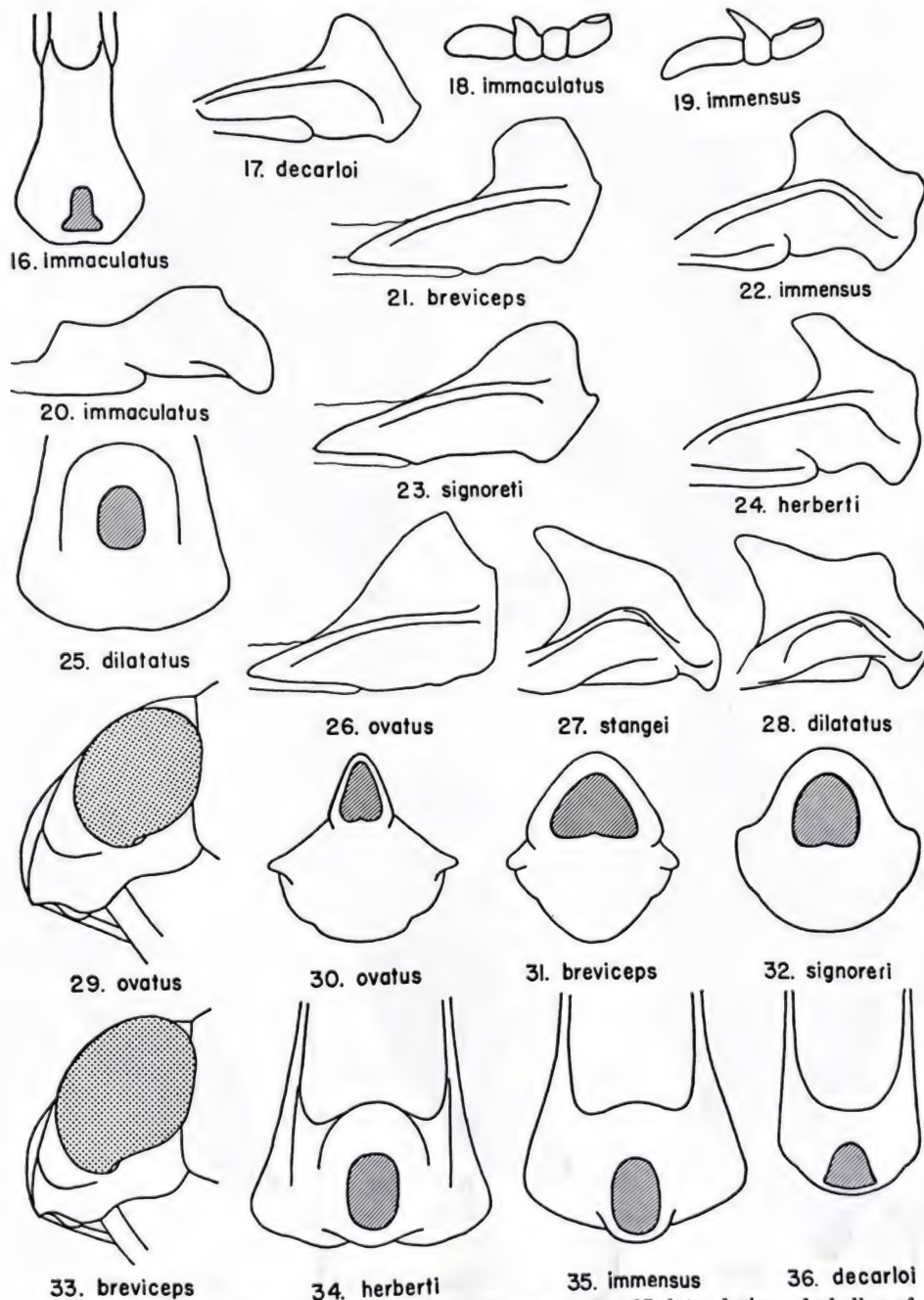
Head: Eye somewhat flattened externally, as high as or slightly higher than interocular space; eye width equal to or slightly greater than one-half width of interocular distance; length of tylus varying from about two-thirds to three-fourths eye length; ratio of length of beak segments starting with basal one: 1.7:1.5:9; antenna composed of 4 definite segments with an elongate finger-like process on segments II and III (fig. 3); fingers subequal in length to last antennal segment.

Thorax: Median length of posterior lobe of pronotum equal to or slightly greater than one-half median length of anterior lobe; anterior angles of pronotum angulate or slightly rounded.

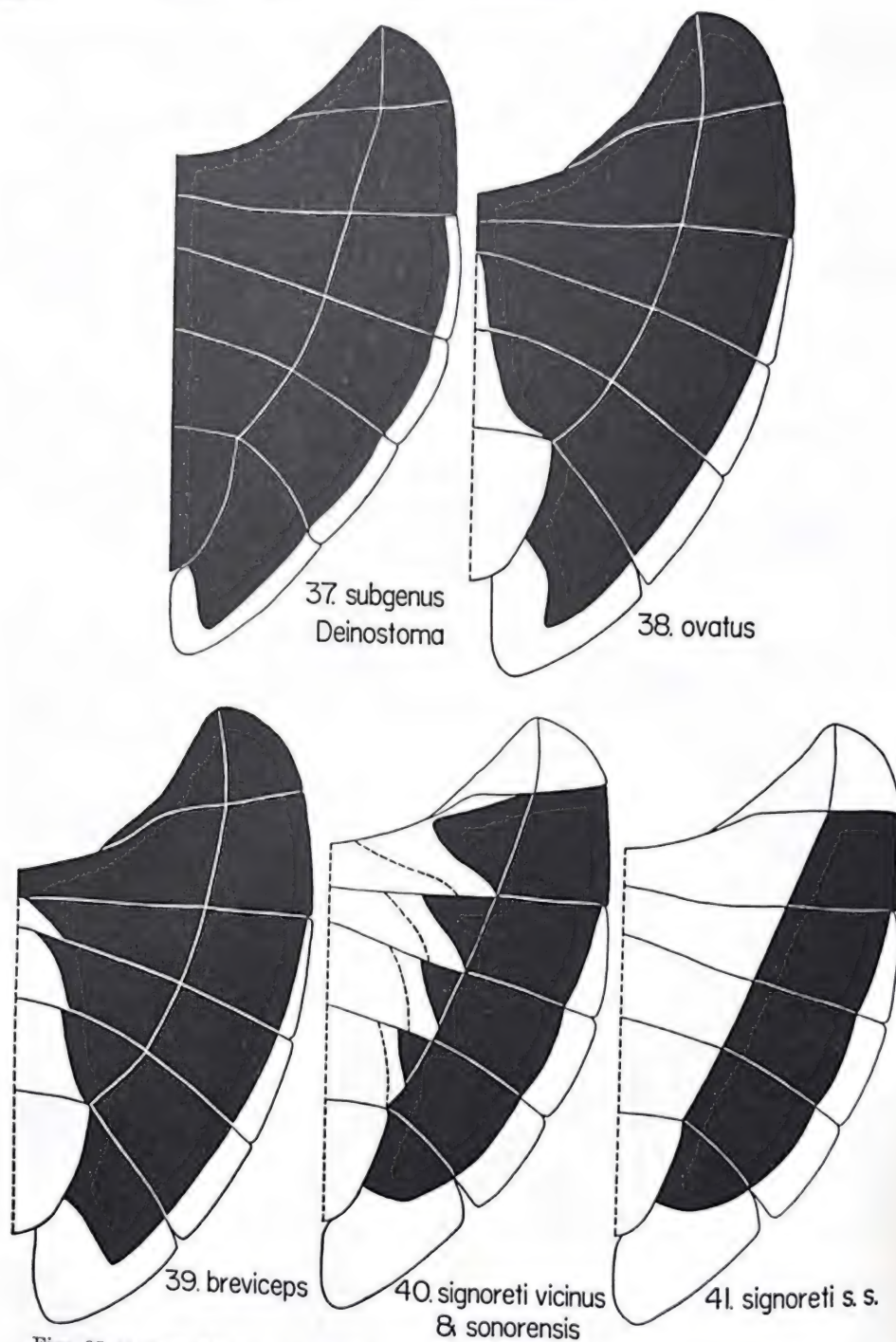
Hemelytron: Embolial fracture present or absent; membrane well developed for the genus



Figs. 1-15. Figures of air straps are of the dorsum of right male strap unless two are figured for one species, in which case figure *a* is the male and figure *b* the female. 1, air strap of *A. immaculatus* (♂, ♀); 2, air strap of *A. signoreti* s.l. (♂, ♀); 3, antenna of *A. breviceps*; 4, *a*, *b*, antenna of *A. ovatus*; 5, antenna of *A. indentatus*; 6, *a*, *b*, antenna of *A. dilatatus*; 7, *a*, *b*, air strap of *A. herberti* s.l.; 8, air strap of *A. indentatus*; 9, *a*, *b*, air strap of *A. stangei*; 10, *a*, *b*, air strap of *A. ovatus*; 11, *a*, *b*, air strap of *A. breviceps*; 12, *a*, *b*, air strap of *A. immensus*; 13, *a*, *b*, air strap of *A. herberti herberti*; 14, air strap of *A. decarloi*; 15, *a*, *b*, air strap of *A. dilatatus*.



Figs. 16-36. 16, dorsal view of phallus of *A. immaculatus*; 17, lateral view of phallus of *A. decarloi*; 18, antenna of *A. immaculatus*; 19, antenna of *A. immensus*; 20, lateral view of phallus of *A. immaculatus*; 21, lateral view of phallus of *A. breviceps*; 22, lateral view of phallus of *A. immensus*; 23, lateral view of phallus of *A. signoreti* s.l.; 24, lateral view of phallus of *A. herberti* s.l.; 25, dorsal view of phallus of *A. dilatatus*; 26, lateral view of phallus of *A. ovatus*; 27, lateral view of phallus of *A. stangei*; 28, lateral view of phallus of *A. dilatatus*; 29, lateral view of head of *A. ovatus*; 30, apical view of phallus of *A. ovatus*; 31, apical view of phallus of *A. breviceps*; 32, apical view of phallus of *A. signoreti* s.l.; 33, lateral view of head of *A. breviceps*; 34, dorsal view of phallus of *A. herberti* s.l.; 35, dorsal view of phallus of *A. immensus*; 36, dorsal view of phallus of *A. decarloi*.



Figs. 37-41. These figures of ventral abdominal and laterotergite pubescence refer to the left half of the venter, the black area denoting pubescence. 37, ventral abdominal and laterotergite pubescence of subgenus *Deinostoma*; 38, ventral abdominal and laterotergite pubescence of *A. ovatus*; 39, ventral abdominal and laterotergite pubescence of *A. breviceps*; 40, ventral abdominal and laterotergite pubescence of *A. signoreti vicinus* (solid triangles) and *A. signoreti sonorensis* (dashed line triangles); 41, ventral abdominal and laterotergite pubescence of *A. signoreti s.s.*

with 6 to 9 elongate cells, some of which are formed by a forking vein; greatest width of membrane and translucent margin combined slightly less than or equal to twice median length of posterior lobe of pronotum; apex of hemelytron evenly but rather acutely rounded.

Abdominal venter: Abdominal plates completely glabrous or with small triangular patches of hair laterally along margin of ventral laterotergites; ventral laterotergites covered with pubescence except plate I and distal one-half of plate VI.

Air strap: Narrow, elongate, without a division into a basal stalk and an apical lobe, identical in both sexes; dorsal surface covered with long hairs except for apical one-fourth (fig. 2).

Phallus: Opening of ejaculatory duct nearly triangular, slightly higher than wide; roof over duct a broadly rounded ridge; lateral wings disappearing before apex, not visible in apical view (figs. 23, 32).

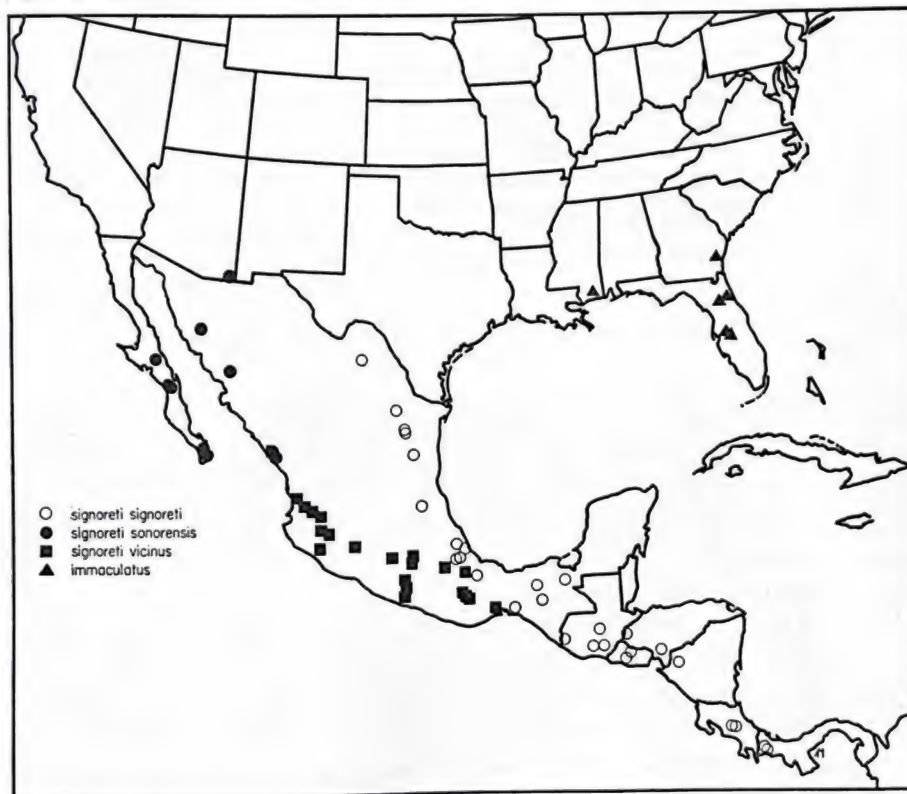


Fig. 42. Distribution map for *A. signoreti* s.l. and *immaculatus*.

The phallus varies in its general appearance and may resemble that of *breviceps* in some specimens.

The long narrow air straps plus the rather well-developed membrane make this species unique in *Abedus*. The two subspecies *vicinus* and *sonorensis* may be confused with *A. breviceps*, but the air straps will distinguish them. *A. signoreti* is almost *belostoma*-like in its body form and it makes a convenient intermediate linking the two genera. The enlarged membrane is more like *Belostoma* than *Abedus*.

Distribution (fig. 42).—This species has the greatest range of any in the genus. It is found from northern Panama to southern Arizona and Baja California. In

México it seems restricted to the coastal regions where it inhabits the coastal drainage systems. I have not seen any material from the high central plateau. There are at least three and possibly four distinct populations within the species. One population extends from Panama to the Isthmus of Tehuantepec and then up the east coast of México to northern Coahuila and possibly Texas. A second population exists along the west coast of México from central Oaxaca to southern Sinaloa. The third population that I have recognized extends from Sinaloa, México, to southern Arizona and Baja California. The specimens from Baja California may represent a fourth subspecies but I have not found a reliable means of defining it except by its geographical position. The three subspecies can be separated by the following key:

1. Ventral abdominal plates completely glabrous, without triangles of pubescence laterally along mesal margin of ventral laterotergites (fig. 41); embolial fracture absent; Panama to Coahuila, México (east coast of México).....*Abedus signoreti signoreti* Mayr
- Ventral abdominal plates with triangular patches of silky pubescence laterally along ventral laterotergites (fig. 40); embolial fracture present or absent; Oaxaca, México to Baja California and southern Arizona (west coast of México).....2
2. Embolial fracture present; Oaxaca to Sinaloa, México.....*Abedus signoreti vicinus* Mayr
- Embolial fracture absent; Sinaloa to southern Arizona, and Baja California
Abedus signoreti sonorensis Menke, n. subsp.

Abedus (*Pseudoabedus*) *signoreti signoreti* Mayr

(Figs. 41, 42)

Abedus signoreti Mayr, 1871, Verh. K. K. Zool.-Bot. Ges. Wien, 21:404-405 (♂, ♀); Champion, 1901, Biol. Centr.-Amer., 2:363-364 (listed); Montandon, 1903, Bul. Soc. Sci. Buc., 12(1-2):113 (syn.); Kirkaldy and Bueno, 1909 (in part); Proc. Ent. Soc. Wash., 10(3-4):190 (cat.); De Carlo, 1932, Rev. Soc. Ent. Arg. no. 22:121 (listed); Hidalgo, 1935 (in part), Univ. Kans. Sci. Bull., 22(16):498 (rev.); De Carlo, 1938 (in part), Anal. Mus. Arg. Cienc. Nat., 39:242; De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:7-8 (rev.); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:71 (listed).

Size: Length, 20.5-27 mm.; width, 12-15 mm.

Diagnostic features: Anterior angles of pronotum usually angulate rather than rounded; embolial fracture always absent; in males embolium very broad throughout length; greatest width of membrane and translucent margin combined slightly less than twice median length of posterior lobe of pronotum; ventral abdominal plates usually completely glabrous (fig. 41); most specimens a little wider through hemelytra than long; appearance quite broad.

There is little variation in any characters except the size and shape.

The lack of pubescence on the abdominal plates makes it unlikely that this subspecies will be confused with any other member of the genus. Specimens from Oaxaca may grade into *vicinus*, and the presence or absence of the embolial fracture will then be used for diagnosis.

Types.—Mayr did not designate a holotype. Through the courtesy of Dr. Lars Brundin of the Stockholm Museum I was able to see two of the three syntypes on which Mayr based his species. The third syntype, which I did not see, is in the Vienna Museum in Austria. Dr. Robert Usinger took notes on the *Abedus* in that museum for me in 1958. According to his notes the Vienna syntype is from Guatemala and bears Signoret's collection label. This agrees with Mayr's statement in his 1871 paper. One of the Stockholm syntypes is a female and bears the following labels: México, Stål, *Abedus signoreti* n. sp. (in handwriting), typus (machine-

printed on red card), and #233-58. I am selecting this specimen as the lectotype. It is deposited in the Stockholm Naturhistoriska Riksmuseet, Sweden. The other Stockholm syntype is a male and bears the following labels: México, Salle, *signoreti* n. sp. (in handwriting), paratypus (machine-printed on red card), and #234-58. As in the syntypes of *ovatus* and *breviceps* the "typus" and "paratypus" labels were a recent addition. The lectotype female is 24 mm. long and 14 mm. wide. There is no embolial fracture and the pubescence of the abdomen is restricted to the ventral laterotergites.

Distribution (fig. 42).—I have seen specimens from Coahuila, México, to Panama, and I suspect that the subspecies will be found in Texas as well. In México it occurs only along the east coast. I have seen several specimens labeled "New Grenada" from Stockholm. At one time New Grenada included Colombia and most of Panama. It is not known whether this subspecies occurs in Colombia since it is not recorded in the literature from there, and I have seen no authentic specimens. This subspecies has a zone of overlap with *vicinus* in Oaxaca, and in this area some specimens may have some pubescence on the abdominal plates but lack the embolial fracture.

Material examined (126 specimens).—COSTA RICA. Cartago, July 11, 1932, B. Kaiser, ♂, ♀ (RLU); Moravia, Chirripo Prov., Cartago, June, 1957, J. De Abate, 2 ♂♂ (AM); Cache, H. Rogers, ♂ (Stockholm); San José, Jan., 1905, P. Biolley, ♀ (RFH); April, 1906, P. Biolley, 2 ♀♀ (Stockholm, AM); June-July, 1931, H. Schmidt, 2 ♂♂ (UK); Palmares, San José, July 15, 1957, D. Lauck and W. Wheateroft, ♂ (DRL); Rio María Aguilar, San José, May, 1905, P. Biolley, ♂ (AMNH); Rio Tiribí, San José, July 15, 1957, J. De Abate, 4 ♂♂, 2 ♀♀ (AM); Rio Virilla, Dec. 26, 1931, H. Schmidt, ♂, ♀ (UK); Vista del Mar, March, 1905, P. Biolley, ♀ (CAS).

EL SALVADOR. Rio Acelhuate, San Salvador, Jan. 21, 1924, Hildebrand and Foster, ♂ (USNM); San José del Sacare, Chalatenango, March 13, 1927, R. Stirton, ♂ (UK).

GUATEMALA. El Salto Esequintla, 1934, F. Williams, 2 ♂♂ (UK); Malacatlan, San Marcos, July 2, 1957, D. Lauck and W. Wheateroft, 2 ♂♂, 2 ♀♀ (DRL); Rio Guaca Lake, dept. Escuintla, Feb. 5, 1935, C. Hubbs, ♂ (UMMZ); 20 kms. N. Salama, March 24, 1946, E. Miller, ♂, ♀ (USNM); Santa Rosa, July 5, 1957, D. Lauck and W. Wheateroft, 6 ♂♂, 5 ♀♀ (DRL).

HONDURAS. Camayaguela, Morazán, July 22, 1957, D. Lauck and W. Wheateroft, 2 ♂♂, 2 ♀♀ (DRL); Copán, Feb. 7, 1937, C. Roys, ♂ (UK).

MEXICO. CHIAPAS: Guadalupe, Jan. 15, 1938, O. Utrilla, ♀ (UK); La Libertad, Jan. 1, 1938, O. Utrilla, ♂, ♀ (UK); 7 mi. SE. Soyalo, March 27, 1953, R. Bechtel and E. Schlinger, ♂, ♀ (CIS). COAHUILA: Nacimiento, Rio Sabinas, March 30, 1938, E. Marsh, Jr., ♂ (UMMZ). NUEVO LEÓN: Arroyo de Lajillas, 10 mi. S. Linares, Dec. 18, 1940, H. Hobbs and W. McLane, ♂ (UMMZ); Linares, April 22, 1930, Creaser and Gordon, ♀ (UMMZ); Monterrey, April 17, 1930, Creaser and Gordon, ♂, ♀ (UMMZ); 6 mi. S. Monterrey, Aug. 12, 1959, A. Menke and L. Stange, 10 ♂♂, 12 ♀♀ (AM). OAXACA: 4 mi. E. Papaloapán, Feb. 22, 1939, Gordon and Atz, ♂ (UMMZ); Rio Santa Catarina, 2 mi. W. Santa Catarina, Jan. 11, 1939, Gordon and Atz, 2 ♂♂, ♀ (UMMZ); 7 mi. NE. Tapanatepec, July 9, 1953, ♀ (UK); 3 mi. N. Tapanatepec, Dec. 21, 1955, J. Schaffner, ♂ (UI). SAN LUIS POTOSÍ: Rio Axtla, Danubio, April 7, 1948, M. Gordon, ♂ (AMNH); 5 mi. N. Tamazunchale, Dec. 22, 1948, H. Leech, ♀ (CAS). TAMAULIPAS: Victoria, Dec. 10, 1909, F. Bishopp, ♂ (USNM). VERA CRUZ: Córdoba, ♂ (AMNH); 7 mi. E. Córdoba, Dec. 27, 1958, A. Menke and L. Stange, ♀ (AM); Jalapa, Dec. 26, 1958, A. Menke and L. Stange, ♀ (AM); Orizaba, Bottin, ♀ (USNM); 3 mi. W. Paso de Ovejas, Dec. 26, 1958, ♂, ♀ (AM); Rio Antigua and highway 56, Dec. 26, 1958, A. Menke and L. Stange, ♀ (AM); 8 mi. NE. Tlapacoyan, Aug. 16, 1959, A. Menke and L. Stange, 3 ♀♀ (AM).

NICARAGUA. 8 mi. S. Condega, Esteli, July 16, 1956, A. Alcorn, ♂, 10 ♀♀ (UN).

PANAMA. Chiriqui, O. Staudinger, ♂ (UK); Potrerillos, Jan., 1934, D. Brown, 2 ♂♂, 8 ♀♀ (RLU); Feb. 15, 1935, D. Brown, ♂ (UK).

Abedus (Pseudoabedus) signoreti vicinus Mayr

(Figs. 40, 42)

Abedus vicinus Mayr, 1871, Verh. K. K. Zool.-Bot. Ges. Wien, 21:405 (♂, ♀); Champion, 1901, Biol. Centr.-Amer., 2:364 (syn.).

Abedus usingeri De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:8-9 (♂, ♀) (new synonymy); Hussey and Herring, 1950, Fla. Ent., 33(2):84-85 (mentioned); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:71 (listed).

Size: Length, 22-27 mm.; width, 11.5-14.5 mm.

Diagnostic features: Anterior angles of pronotum usually rounded rather than angulate; embolial fracture always present (about opposite apex of scutellum); embolium of males not conspicuously broadened, at least basally; width of membrane and translucent border equal to twice median length of posterior lobe of pronotum; ventral abdominal plates with small triangles of pubescence laterally along mesal margin of ventral laterotergites (fig. 40, solid triangles); most specimens about twice as long as wide; bugs appear very narrow due to narrow embolium.

In some specimens the embolial fracture is not well developed, especially in Oaxaca and Sinaloa, the ranges of overlap with the other two subspecies. In some specimens the triangles of pubescence are worn or greased over so that they appear not to be present. In Oaxaca, the zone of overlap with *signoreti* s.s., the triangles may be very poorly developed.

This form is separated from both of the other two subspecies of *signoreti* by the presence of the embolial fracture combined with the triangles of pubescence on the ventral abdominal plates. It is distinguished from *Abedus breviceps* by the air straps. Specimens of this subspecies will grade into both the other two subspecies at points of overlap and positive identification in these cases may be difficult.

Champion (1901) synonymized *vicinus* with *signoreti*, stating that "the slight differences mentioned by Mayr are probably sexual..." Champion apparently overlooked the embolial fracture and the triangles of pubescence (as did Mayr) when he examined the types. Mayr (1871) used the position of the spiracle on ventral laterotergite VI as a means of separating *vicinus* from *signoreti*, but I have not found this to be of any value. *Abedus usingeri* De Carlo is clearly a synonym of *vicinus*. I have examined three specimens from the University of Kansas Collection which were part of the original series from which Dr. De Carlo described *usingeri* (El Sabino, Uruapan, July 20, 1936, H. Thomas). These specimens agree with Dr. De Carlo's description and have in addition the embolial fracture which he apparently did not notice.

Types.—Through the courtesy of Dr. Eric Kjellander of the Stockholm Museum I was permitted to examine the types of *Abedus vicinus*. There are two syntypes, one male and one female. The male bears the following information: Oaxaca, Salle, *Abedus vicinus* n. sp. (hand written), typus (machine-printed on red card). I am selecting this specimen as the lectotype. It is deposited in the Stockholm Naturhistoriska Riksmuseet, Sweden. The female bears the following labels: Oaxaca, Salle, paratypus (machine-printed on red card), and #75-59. As in the other Stockholm syntypes, the "typus" and "paratypus" labels are a recent addition. The lectotype male is 27 mm. long and 14.2 mm. wide.

Distribution.—The range of this subspecies is western coastal México from Oaxaca to southern Sinaloa. It seems restricted to the mountainous coastal regions and I have not seen any specimens from the interior plateau. *A. vicinus* overlaps the range of *sonorensis* in Sinaloa and Nayarit and I have seen both in series collected from certain localities in these states. The same is true in Oaxaca, where *vicinus* overlaps the range of *signoreti* s.s.

Material examined (196 specimens).—MEXICO. COLIMA: Colima, March, 1929, O. Standinger and A. Bang Haas, 2 ♀♀ (UK); 7 mi. NE. Colima, Dec. 3, 1948, H. Leech, ♀ (CAS). GUERRERO: between Cajones and Rincon, S. of Chilpancingo, July 1, 1932, H. Smith, ♀ (UK); Rio Balsas, jet. Acapulco highway, June 24, 1932, H. Smith, 2 ♀♀ (UK); Tierra Colorada, Oct. 31, 1936, H. Thomas, ♂ (UK); Rio Papagayo nr. Tierra Colorada, May 4, 1955, F. Truxal, ♂ (LACM); 9 mi. N. Zumpango, Jan. 8, 1956, J. Schaffner, ♀ (UI). JALISCO: Barranquitas, April 20, 1955, F. Truxal, ♀ (LACM); La Quemada, Dec. 30, 1958, A. Menke and L. Stange, 6 ♂♂, 8 ♀♀ (AM); Rio Apmeca, 2 mi. NW. La Huerta, March 10, 1957, R. Miller, ♂, ♀ (UMMZ); Rio Verde nr. mouth of Rio Grande de Santiago, March 3, 1957, R. Miller, 2 ♀♀ (UMMZ); Santa Cruz Astillero, Dec. 30, 1958, A. Menke and L. Stange, ♂, 3 ♀♀ (AM); Tecolotlán, Sept. 15–17, 1938, H. Thomas, ♂, ♀ (UK). MÉXICO: Tejupileco, dist. of Temascaltepec, June 15–19, 1933, H. Hinton and R. Usinger, 2 ♂♂ (CAS). MICHOACÁN: El Sabino, Uruapán, July 20, 1936, H. Thomas, 2 ♂♂, ♀ (UK). MORELOS: Alpuyecá, June 27–July 3, 1951, P. Hurd, 2 ♂♂, ♀ (CIS); Cuernavaca, May, 1921, E. Ball, ♂ (UK); Oct. 5, 1936, H. Thomas, ♂, ♀ (UK); 14 mi. S. Cuernavaca, Dec. 8, 1948, H. Leech, ♀ (CAS); Temixco, May 3, 1955, F. Truxal, ♂ (LACM). NAYARIT: Ahuacatlán, Aug. 12, 1957, D. Lauck and W. Wheateroft, 6 ♂♂, 9 ♀♀ (DRL); Compostela, Dec. 30, 1958, A. Menke and L. Stange, 8 ♂♂, 5 ♀♀ (AM); 5 mi. N. Compostela, Dec. 31, 1958, A. Menke and L. Stange, ♀ (AM); Ixtlán del Rio, Sept. 22, 1953, B. Malkin, 2 ♂♂, 3 ♀♀ (CAS); 6 mi. E. Ixtlán del Rio, Dec. 30, 1958, A. Menke and L. Stange, ♀ (AM); Tepic, March, 1923, 3 ♂♂, 2 ♀♀ (USNM); 25 kms. S. Tepic, Sept. 24, 1953, B. Malkin, 2 ♂♂, ♀ (CAS); 22 mi. SE. Tepic, Dec. 30, 1958, A. Menke and L. Stange, ♀ (AM). OAXACA: Oaxaca, Aug. 20–25, 1937, M. Embury and H. Thomas, ♂, 2 ♀♀ (UK); July 8, 1952, E. Gilbert and C. MacNeil, ♀ (CIS); 9 mi. N. Oaxaca, Dec. 12, 1948, H. Leech, ♀ (CAS); 45 kms. SE. Oaxaca, July 13, 1952, E. Gilbert and C. MacNeil, ♀ (CIS); 3 mi. S. Oaxaca, Rio Mitla, April 1, 1957, R. Miller, ♂ (UMMZ); Tequisistlán, June 28, 1957, D. Lauck and W. Wheateroft, 3 ♂♂, 2 ♀♀ (DRL); Corriente (Corriente Ancha?), Aug. 24, 1937, H. Thomas, 2 ♀♀ (UK); 18 mi. NW. El Camaron, Aug. 20, 1959, A. Menke and L. Stange, 2 ♂♂, ♀ (AM); Macuilxochitl, Aug. 21, 1959, A. Menke and L. Stange, 7 ♂♂, 11 ♀♀ (AM); 48 mi. W. Tehuantepec, Aug. 20, 1959, A. Menke and L. Stange, 11 ♂♂, 9 ♀♀ (AM). PUEBLA: Tehuacán, July 18–25, 1937, H. Thomas, ♂ (UK); 3 mi. NW. Petalcingo, Aug. 22, 1959, A. Menke and L. Stange, 2 ♂♂, ♀ (AM). SINALOA: Los Mayos, July 24, 1952, J. Lattin, ♂ (CIS); Rio Quelite, 23 mi. N. Mazatlán, July 22, 1952, J. Lattin, ♀ (CIS).

***Abedus* (*Pseudoabedus*) *signoreti sonorensis* Menke, n. subsp.**

(Figs. 40, 42)

Size: Length, 22.5–29 mm.; width, 12–16 mm.

Diagnosis: Anterior angles of pronotum rounded; embolial fracture absent; embolium of males broad at middle of hemelytron but not at base, broadening gradually to midpoint of hemelytron; width of membrane and translucent border combined equal to twice median length of posterior lobe of pronotum; ventral abdominal plates with large triangular patches of pubescence laterally along mesal margin of ventral laterotergites, patches reaching full length of each abdominal plate along ventral laterotergites (fig. 40, dashed lines); form of bug narrow to broad; specimens about twice as long as wide.

The triangles of pubescence on the abdominal plates tend to be larger in more northern specimens. Specimens from Baja California are larger and slightly broader than the more typical mainland forms.

This subspecies is differentiated from the other two by the combination of the

absence of an embolial fracture and the presence of the triangles of pubescence. *Sonorensis* may be confused with *A. breviceps* but the air straps are distinctive.

Types.—Holotype male, allotype female, and one male paratype: Hermosillo, Sonora, México, July 9–16, 1953, B. Malkin; one male paratype: Alamos, Sonora, México, Nov. 15, 1933, H. S. Gentry; two female paratypes: 2 mi. E. Guirocoba, April 30, 1939, C. Sibley; 2 male and 3 female paratypes: San Bernardino Ranch, Cochise Co., Arizona, April 7, 1944, M. H. Frost, Jr.; one male paratype: San Bernardino Ranch, Cochise Co., Arizona, April 1, 1958, A. Menke and L. Stange.

The holotype and allotype are deposited in the California Academy of Sciences. The paratypes will be distributed as follows: California Academy of Sciences, Los Angeles County Museum, University of Arizona, University of Kansas, University of Michigan, U. S. National Museum and my own collection. I am not selecting paratypes from the Baja California material before me because they are not quite typical of the subspecies.

Distribution.—*Abedus signoreti sonorensis* ranges from southern Sinaloa, México, to southern Arizona and Baja California. It is typically a desert subspecies, overlapping in range with *vicinus* in southern Sinaloa. Uhler's 1894 record of *Abedus ovatus* from Baja California probably refers to this subspecies since *ovatus* is not known to occur in northern México. In addition to the types I have seen the following material:

Material examined (75 specimens).—MEXICO. BAJA CALIFORNIA: Comondú, July 22, 1938, Michelbacher and Ross, ♀ (CAS); La Purísima, Comondú, May 24, 1947, I. La Rivers, ♀ (CAS); Arroyo de la Purísima, 1 mi. N. La Purísima, Dec. 27, 1958, 2 ♂♂ (CAS); Miraflores, Jan. 8, 1959, A. Smith, 2 ♂♂, ♀ (CAS); Padrone, Amarillo Arroyo, May 11, 1947, I. La Rivers, ♂, 5 ♀♀ (CIS); San Bartolo (dam), May 1, 1947, I. La Rivers, 2 ♂♂, 3 ♀♀ (CIS); 5 mi. W. San Bartolo, July 13, 1938, Michelbacher and Ross, ♂, ♀ (CAS); San Ignacio, June 26, 1938, Michelbacher and Ross, 2 ♀♀ (CAS); San José de Comondú, Feb. 16, 1947, I. La Rivers, ♂, ♀ (CIS); San Luis (Pilar), May 22–23, 1947, I. La Rivers, 6 ♂♂, 2 ♀♀ (CIS); San Luis Gonzaga, May 24, 1947, I. La Rivers, ♀ (CAS); Santiago, July 22, 1919, J. Slevin, 8 ♂♂ (CAS); July 8, 1938, Michelbacher and Ross, ♂ (CAS); Las Animas, Sierra Laguna, Oct. 12, 1941, Ross and Bohart, ♂ (CAS); Big Canyon, Sierra Laguna, Oct. 13, 1941, Ross and Bohart, ♂ (CAS). SINALOA: Los Mayos, July 24, 1952, J. Lattin, 2 ♀ (CIS); 36 mi. N. Mazatlán, Nov. 18, 1955, J. Schaffner, 6 ♂♂, 7 ♀♀ (UI); Rio Quelite, 23 mi. N. Mazatlán, July 22, 1952, J. Lattin, ♀ (CIS). SONORA: Palmar district, Alamos, Oct. 27, 1934, H. Gentry, ♂ (UK); Rio Cuchahuqui, 7 mi. S. Alamos, July 25–Aug. 7, 1953, F. Truxal, ♀ (LACM); Arroyo el Cajou, nr. Cajou, Feb. 16, 1957, R. Miller, ♀ (UMMZ).

Abedus (Microabedus) immaculatus (Say)

(Figs. 1, 16, 18, 42)

Belostoma fluminea, variety *immaculata* Say, 1932, Descriptions of new species of Heteropterous Hemiptera of North America (Fitch Reprint: 1858, Trans. New York State Agr. Soc., 17:809).

Abedus immaculatus, Hussey and Herring, 1950, Florida Ent., 33(4):154–156 (syn.); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:72 (listed); Wilson, 1958, Tulane Studies Zool., 6(3):152–153 (listed, dist.).

Abedus cantralli Hussey and Herring, 1950, Florida Ent., 33(2):84–89.

Size: Length, 12.4–14.3 mm.; width, 6–7 mm.

Head: Eye rounded externally and much lower than interocular space; longitudinal sulcus mesad of each eye rather uniformly shallow, interocular space between sulci uniformly convex; eye width equal to one-half interocular distance; clypeus prominent anteriorly, head flattened from vertex to middle of clypeus in lateral view; length of tylus greater than eye length; ratio

of length of beak segments starting with basal one: 1.5:1.7:.9; antenna 4-segmented, II without lateral projections, III with a short tooth (fig. 18).

Thorax: Median length of posterior lobe slightly less than one-half median length of anterior lobe; anterior angles of pronotum angulately rounded.

Hemelytron: Embolial fracture present; membrane poorly developed, 4 or 5 cells present; greatest width of membrane and translucent margin combined twice median length of posterior lobe of pronotum; margin of apex of hemelytron acutely rounded; hemelytron usually with irregularly formed longitudinal brown stripes.

Abdominal venter: Abdominal sternites and genital plate glabrous; ventral laterotergite I glabrous but covered with spinules, II-V covered laterally with a mat of hairs which grade into spinules at mesal margin, VI with a small triangular patch of hairs at inner basal angle.

Air strap: Narrow, elongate, without a division into basal stalk and an apical lobe, apex acute, identical in both sexes (fig. 1).

Phallus: Opening of ejaculatory duct keyhole shaped; lateral wings poorly developed (figs. 16, 20).

No significant variation has been observed.

Abedus immaculatus is unlike any other *Abedus*. Its small size, small eyes, unique antenna, and the acute apex of the hemelytron readily separate this species from all the others in *Abedus*. *A. immaculatus* in most respects appears more belostoma-like but because of the reduced membrane is placed in *Abedus*. The reader is referred to the fine illustration of this species in Hussey and Herring (1950).

Types.—The original specimen or specimens on which Say based this species are presumed lost. The type of *cantralli* is in the Museum of Zoology of the University of Michigan.

Distribution (fig. 42).—This species is known from Georgia, Florida, and Mississippi, an area far removed from the distribution of the remainder of the species in *Abedus*. Most of the known specimens have been collected in northern Florida; and Dr. Roland Hussey has told me (personal correspondence) that intensive collecting in the area between Mississippi and Florida has not produced any examples of this seemingly rare bug.

Material examined (50 specimens).—FLORIDA: Gainesville (RFH); Kissengen Springs (RFH); Lake Placid (UK); 11 mi. N. Lakeland (RFH, RLU); Miami (UK); Royal Palm Park (UK); Zolfo Springs (UK). GEORGIA: Jesup (RFH); Okefenokee Swamp (UK). MISSISSIPPI: 15 mi. N. Biloxi (UC).

Abedus (Abedus) ovatus Stål

(Figs. 4, a-b, 10, a-b, 26, 29, 30, 38, 43)

Abedus ovatus Stål, 1862, Ent. Zeitung, 23(10-12):461 (2 ♂♂); Dufour, 1863, Ann. Soc. Ent. France, 32:396 (desc.); Mayr, 1871, Verh. K. K. Zool.-Bot. Ges. Wien, 21:404 (key, listed); Uhler, 1875 (in part), Bull. U. S. Geol. Geog. Surv. Terr., 1:338 (listed); Champion, 1901, Biol. Centr.-Amer., 2:363 (listed); Kirkaldy, 1906, Trans. Amer. Ent. Soc., 32(2):151 (cat.); Kirkaldy and Bueno, 1909 (in part), Proc. Ent. Soc. Wash., 10(3-4):189 (cat.); Van Duzee, 1917 (in part), Cat. Hemip. Amer. No. Mex., p. 469 (cat.); Hidalgo, 1935, Univ. Kans. Sci. Bull., 22:499-500 (rev.); De Carlo, 1938 (in part), Anal. Mus. Arg. Cienc. Nat., 39:243 (desc.); De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat. 5:10 (rev.); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:70 (listed).

Stenoscytus mexicanus Mayr, 1863, Verh. K. K. Zool.-Bot. Ges. Wien, 13:347.

The following citation probably refers to this species:

Abedus breviceps, Kirkaldy and Bueno, 1909 (in part), Proc. Ent. Soc. Wash., 10(3-4):189 (cat.).

Size: Length, 20-26 mm.; width, 11.5-15 mm.

Head: Eye evenly rounded externally, globular, slightly higher than interocular space (fig. 29); width of eye about one-half interocular distance; length of tylus before eye about three-fourths eye length; ratio of beak segment lengths starting with basal one: 2:1.4:1.9; antenna usually of 3 definite segments with a tooth or tubercle or more commonly a short fingerlike process on segment II, segment III with a short fingerlike process and sometimes partly divided into a fourth segment (fig., 4, a, b).

Thorax: Median length of posterior lobe of pronotum equal to one-half median length of anterior lobe; anterior angles of pronotum angulate, not rounded; area of pronotum between fossa and eye raised, giving a warty appearance.

Hemelytron: Embolial fracture usually present; membrane nonexistent, only a narrow translucent margin of hemelytron visible as "membrane," greatest width of translucent margin about one-half or less the median length of posterior lobe of pronotum; apex of hemelytron evenly rounded.

Abdominal venter: Except for glabrous median area of abdominal plates IV and V, venter is completely covered with a mat of long, rather dense, but not closely appressed hairs; glabrous area of plate IV very narrow, but it expands to width of base of genital plate on plate V (fig. 38); ventral laterotergites pubescent except for apical third of plate VI.

Air strap: Base of lobe of strap dorsally bearing a sac; apex of lobe deflexed downward along patch of hairs; female strap same as in male but narrower and smaller (fig. 10, a, b).

Phallus: Opening of ejaculatory duct a high narrow triangle; roof over ejaculatory duct a sharply triangular ridge; lateral wings visibly projecting at apex when phallus is viewed apically (figs. 26, 30).

As described above, the antennae vary considerably. The most common type of antenna is illustrated in figure 4, a. Occasionally the third segment is partly divided, almost forming a fourth segment. The size of the glabrous area of the abdominal plates varies also. Specimens from the southern end of the range of the species (Chiapas, México, and Guatemala) have a very small, narrow, spindle-shaped glabrous area on the fourth ventral plate. Specimens from the northern part of its range have a pubescence pattern approaching that of *A. breviceps*. In these latter specimens the third abdominal plate may be glabrous also. The characters of the head and the details of the air strap and phallus will distinguish the species, however. Specimens from Guatemala are very small and may represent a distinct subspecies, but more material must be seen before any definite conclusions can be reached. The prolongations of the antennae are also shorter than normal in these specimens (fig. 4, b).

Abedus ovatus is obviously closely related to *A. breviceps* but the presence of the sac on the air strap and the pattern of abdominal pubescence will readily distinguish them. The eyes are not as large in this species as they are in *breviceps* and are not much higher than the interocular space. *A. ovatus* is readily distinguished from other species in the genus.

Mayr (1871) synonymized his *mexicanus* with *ovatus*, apparently after seeing Stål's specimens.

Types.—I saw Stål's syntypes through the courtesy of Dr. Lars Brundin of the Stockholm Natural History Museum. The two syntypes are males. One specimen bears the following labels: México, Signt., "ovatum" Stål, typus (machine-printed on red card), #228-58. The second specimen has the following data attached:

México, Salle, Stål, paratypus (machine-printed on red card), #229-58. The typus and paratypus labels were recently put on the specimens by Mr. Felix Bryk, according to Dr. Eric Kjellander of the Stockholm Museum (personal correspondence). I have selected the specimen labeled "typus" as the lectotype. It is deposited in the Naturhistoriska Riksmuseet in Stockholm, Sweden. The lectotype is 25 mm. long and 15 mm. wide. The wings are partly spread, and the air straps and phallus are exposed. The embolial fracture is absent.

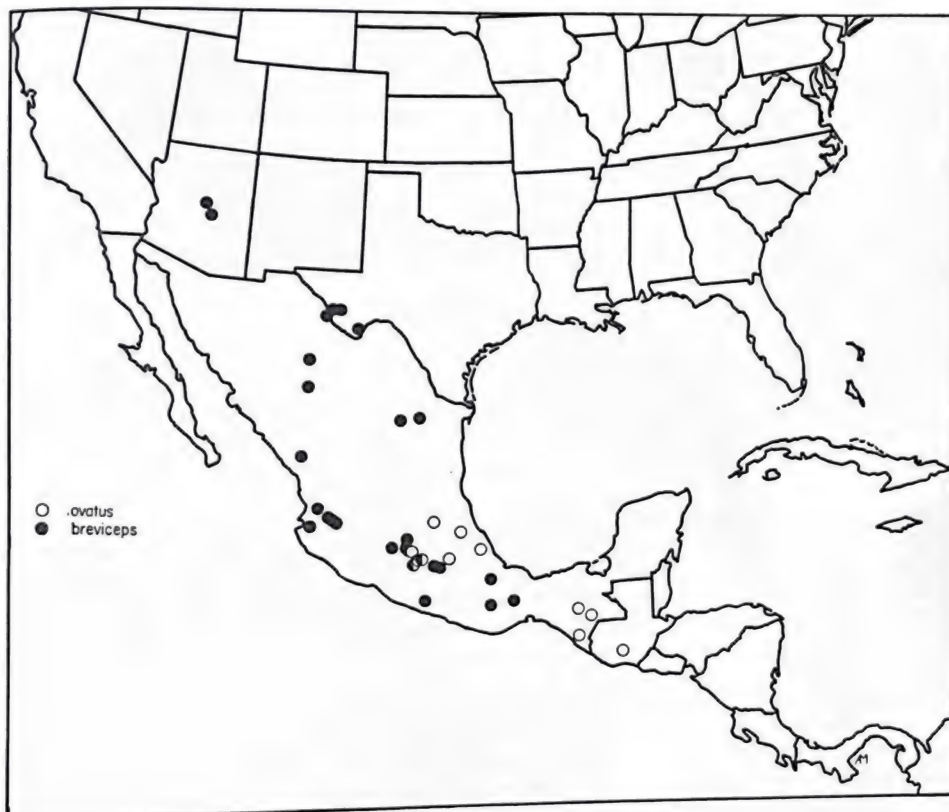


Fig. 43. Distribution map for *A. ovatus* and *breviceps*.

Distribution (fig. 43).—Although this species has been recorded from as far north as the southwest United States, I have seen it only from southern México. These northern records probably were based on misidentifications of *breviceps* or *signoreti*. The range of the species extends from the vicinity of México City to central Guatemala. Further collecting will undoubtedly extend the range in both directions.

Material examined (75 specimens).—GUATEMALA. S. Pedro Yepo, Chimaltenango, Dec., 1948, H. Dalmat, 7 ♂♂, 3 ♀♀ (USNM).

MEXICO. CHIAPAS: Comitán, Aug. 30, 1937, H. Thomas, ♀ (UK); Mt. Obando, 10 mi. N. Escuintla, April 15, 1940, H. Smith, ♀ (UK); San Cristóbal de las Casas, Sept. 2, 1937, H. Thomas, 2 ♀♀ (UK). MÉXICO: Real de Arriba, district of Temascaltepec, May 21-25, 1933, R. Usinger and H. Hinton, 3 ♂♂, 5 ♀♀ (UK, RLU); Rio Salitre and Highway 15, Dec. 28, 1958,

A. Menke and L. Stange, ♂ (AM); Tejupilco, May-June, 1933, H. Hinton, ♂ (UK); Temascaltepec, June 2-5, 1933, R. Usinger, 11 ♂♂, 12 ♀♀ (RLU); 20 mi. E. Zitacuaro, Sept. 19, 1938, H. Thomas, ♀ (UK). OAXACA: Macuilxochitl, Aug. 21, 1959, A. Menke and L. Stange, 2 ♂♂, 10 ♀♀ (AM). PUEBLA: 8 mi. NW. Huejotzingo, Dec. 27, 1958, A. Menke and L. Stange, ♂, 2 ♀♀ (AM); La Puebla, Rio Necaxa, April 3, 1939, M. Gordon, 2 ♀♀ (UMMZ). VERA CRUZ: Jalapa, May 18, 1930, Creaser and Gordon, 4 ♂♂, 3 ♀♀ (UMMZ); Aug. 17, 1959, A. Menke and L. Stange, 2 ♂♂, ♀ (AM).

Abedus (Abedus) breviceps Stål

Figs. 3, 11, a-b, 21, 31, 33, 39, 43)

Abedus breviceps Stål, 1862, Ent. Zeitung, 23(10-12):462 (♂, ♀); Dufour, 1863, Ann. Soc. Ent. France, 32:396 (desc.); Mayr, 1871, Verh. K. K. Zool.-Bot. Ges. Wien, 21:404 (key and listed); Uhler, 1877, Ann. Rep. Geog. Surv. West 100th. Merid. append. N N, p. 1332 (listed); Uhler, 1886, Checkl. Hem. Het. No. Amer., p. 28 (listed); Champion, 1901, Biol. Centr.-Amer., 2:363 (listed); Kirkaldy and Bueno, 1909 (in part), Proc. Ent. Soc. Wash., 10(3-4):189 (cat.); Van Duzee, 1917, Cat. Hem. Amer. No. Mexico, p. 470 (cat.); Hidalgo, 1935, Univ. Kans. Sci. Bull., 22:501 (rev.); De Carlo, 1938, Anal. Mus. Arg. Cienc. Nat., 39:242 (desc.); De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:9 (rev.); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:71 (listed).

The following citations probably refer to this species:

Abedus ovatus, Uhler, 1875, Rept. Geog. Geol. Expl. Surv. West 100th Merid., 5:840 (listed); Uhler, 1875 (in part), Bull. U. S. Geol. Geog. Surv. Terr., 1:338 (listed); Uhler, 1886, Checkl. Hem. Het. No. Amer., p. 28 (Checklist); Kirkaldy and Bueno, 1909 (in part), Proc. Ent. Soc. Wash., 10(3-4):189 (cat.); Banks, 1910, Cat. Nearc. Hem. Het., p. 8 (cat.); Van Duzee, 1917, (in part), Cat. Hem. Amer. No. Mexico, p. 469 (cat.).

Size: Length, 22.5-28 mm.; width, 12-16.5 mm.

Head: Eye somewhat flattened externally, very large, and much higher than interocular space (fig. 33); width of eye nearly two-thirds width of interocular distance; length of tylus before eye less than one-half eye length; ratio of length of beak segments starting with basal one: 2:1.3:8; antenna with 4 definite segments with a long fingerlike process on segments II and III, these processes nearly as long as terminal segment (fig. 3).

Thorax: Median length of posterior lobe of pronotum equal to, or slightly greater than, one-half median length of anterior lobe; anterior angles of pronotum angulate, not rounded; area of pronotum between fossa and eye raised, giving a warty appearance.

Hemelytron: Embolial fracture usually present; membrane present but very narrow and barely differentiated from translucent apical margin, cells square but poorly defined; greatest width of membrane and translucent margin combined equal to median length of posterior lobe of pronotum; apex of hemelytron evenly rounded.

Abdominal venter: Except for the glabrous median area of abdominal plates III through V, venter is completely covered with a mat of long, rather dense, but not closely appressed hairs; glabrous area narrowing only slightly toward base of abdomen and expanding to width of genital plate at apex of plate V (fig. 39); ventral laterotergites pubescent except for apical one-half of plate VI.

Air strap: Base of strap lobe dorsally without a sac, smooth; female strap same as male but smaller (fig. 11, a, b).

Phallus: Opening of ejaculatory duct an equilateral triangle; roof over duct a broadly rounded, triangular ridge; lateral wing visible at apex not projecting laterally (figs. 21, 31).

The antennae are constant in all the specimens of this species I have examined. The glabrous area of the abdominal venter shows a decided tendency to widen as the range extends northward. Specimens from the southern end of the range of the species approach some of the extremes of *ovatus*. In some of the northern

specimens the second abdominal plate is glabrous medianly. In the northern range of the species there tends to be a reduction in the amount of hair on the air strap. The opening of the ejaculatory duct is often variable in shape because the roof over it is not very rigid and the illustration of the apical end of the phallus must be considered with a certain amount of "flexibility." The phallus in lateral view may often resemble that of *signoreti*.

This species is obviously very closely related to *A. ovatus* but the absence of the sac on the air strap and the pattern of abdominal pubescence will serve to differentiate the species. In addition, the larger eyes and the phallus will serve as identification characters. This species may be confused with *signoreti* but large eyes and abdominal and ventral laterotergite pubescence will immediately identify *breviceps*.

Types.—Stål's three syntypes were seen through the courtesy of Dr. Lars Brundin of the Stockholm Museum. Two are females and the other is a male. One female bears the following labels: México, Salle, typus (machine-printed on red card), #230-58. The second female bears the following information: México, Sp. figured, 1647, paratypus (machine-printed on red card), #73-59. The male specimen has the following labels: México, Salle, Stål, paratypus (machine-printed on red card), #231-58. The red typus and paratypus labels were recently placed on the specimens by Mr. Felix Bryk of the Stockholm Museum. I am selecting the female with the "typus" label as the lectotype. It is deposited in the Naturhistoriska Riksmuseet in Stockholm, Sweden. The lectotype is 25.5 mm. long and 15 mm. wide. The wings are spread and the air straps are exposed.

Distribution (fig. 43).—I have seen specimens from central Oaxaca, México, in the south, to as far north as central Arizona, New Mexico, and the Big Bend country of Texas. This species apparently has been misidentified as *ovatus* in the literature. The records for *ovatus* in northern México and the United States probably refer to this species.

Material examined (111 specimens).—UNITED STATES. ARIZONA: Gila Co.: Tonto Creek, Sept. 15, 1926, Hubbs and Schultz, ♀ (UMMZ); Yavapai Co.: Camp Verde, Sept. 2, 1938, C. Hubbs, ♂, ♀ (UMMZ). NEW MEXICO: Cherryville, F. Deivy, ♂ (USNM). TEXAS: Brewster Co.: Big Bend National Park, Aug. 2, 1937, R. Baker, ♂ (TAM); Chisos Mts., July 13, 1930, L. Gloyd, ♂ (UMMZ); Glenn Spring, July 29, 1928, F. Gaige, ♂ (UMMZ); Jeff Davis Co.: Fort Davis, Nov. 18, 1950, Scott, ♂ (TTC); Valentine, July 13, 1927, R. Beamer, ♂, ♀ (UK).

MEXICO. CHIHUAHUA: 10 mi. S. Hidalgo del Parral, Dec. 23, 1958, A. Menke and L. Stange, ♀ (AM); San Antonio, July 15, 1927, P. Readio, ♂ (UK); San Antonio Colonial, July 15, 1927, E. Anderson, ♂ (UK); Rio San Pedro between Chihuahua and Naica, June 22, 1934, Smith and Dunkle, ♂ (UK). COAHUILA: Saltillo, H. Thomas, ♀ (UK). DURANGO: 35 mi. SW. El Salto, July 23, 1953, ♂ (UK). GUANAJUATO: nr. Tarandacuao, Aug. 6, 1932, H. Smith, ♂ (UK). GUERRERO: 9 mi. N. Zumpango, Jan. 8, 1956, J. Schaffner, ♂, 4 ♀♀ (UI). HIDALGO: 3 mi. NE. Jacala, June 22, 1953, ♀ (UK). JALISCO: Barranquitas, March 26, 1955, Miller and Greenbank, 2 ♂♂ (UMMZ); La Quemada, Dec. 30, 1958, A. Menke and L. Stange, ♀ (AM); Rio Mascota above Mascota, March 5, 1957, R. Miller, ♀ (UMMZ); Santa Cruz Astillero, Dec. 30, 1958, A. Menke and L. Stange, ♂, 5 ♀♀ (AM). MÉXICO: Real de Arriba, district of Temascaltepec, May-June, 1933, H. Hinton, ♂, ♀ (UK); Tejupileo, June 16, 1933, H. Hinton and R. Usinger, 3 ♂♂, 5 ♀♀ (CAS). MICHOACÁN: Morelia, Sept. 4-6, 1938, H. Thomas, ♂, ♀ (UK); 5 mi. N. Tuxpan, July 16, 1952, ♀ (UK); Zitacuaro, Aug. 9, 1957, D. Lauck and W. Wheateroft, ♀ (DRL). MORELOS: Morelos, July 14, 1936, H. Thomas, ♀ (UK); Temixco, May 3, 1955, F. Truxal, ♂ (LACM). NAYARIT: 22 mi. SE. Tepic, Dec. 30, 1958, A. Menke and L. Stange, ♂ (AM). NUEVO

LEÓN: Nuevo León, Lt. Couch, ♀ (USNM); Villa de Santiago, March 21, 1940, S. Easter, ♂, 2 ♀♀ (USNM); 6 mi. S. Monterrey, Aug. 12, 1959, A. Menke and L. Stange, 19 ♀♀, 11 ♂♂ (AM). OAXACA: Corriente (Corriente Ancha?), Aug. 24, 1937, H. Thomas, 2 ♂♂ (UK); Rio Mitla, 3 mi. S. Oaxaca, April 1, 1957, R. Miller, ♀ (UMMZ); Tutla, Dec. 13, 1948, H. Leech, ♀ (CAS); Macuilxochitl, Aug. 21, 1959, A. Menke and L. Stange, 2 ♂♂, 3 ♀♀ (AM); 10 mi. NW. Tamaulapán, Aug. 22, 1959, A. Menke and L. Stange, 4 ♂♂, 2 ♀♀ (AM). SAN LUIS POTOSÍ: 15 mi. E. Ciudad del Maiz, Nov. 19, 1948, E. S. Ross, ♀ (CAS).

Subgenus *Deinostoma* Kirkaldy

(Fig. 37)

Since the species of this subgenus are all similar in most of their characters it is more convenient to give a rather thorough subgeneric description here to avoid repetition in the description of each species.

Size rather large, 24.5 to 40 mm. in length; body and legs not strongly shining; head, thorax, legs, and most of venter covered with a scaly or tomentose pubescence; segment I of beak slightly longer than II; anterior angles of pronotum rounded; median length of posterior lobe of pronotum less than one-half median length of anterior lobe; prosternal carina varying from broadly rounded to acuminate in each species; hemelytron without an embolial fracture; membrane linear, main axis almost parallel with longitudinal axis of body; ventral abdominal plates and genital plate completely covered with very short, closely appressed pubescence (genital plate may be thinly glabrous apically around margin) (fig. 37); ventral laterotergites completely covered with pubescence similar to abdomen except for apical part of last plate, hairs of venter red to black; lateral wing of phallus well developed apically, broadened laterally at apex.

Superficially the species of *Deinostoma* look very much alike. The most reliable means of identification is the appearance of the air straps of the male and the phallus. The female straps are in most cases very different from those of the males, and often the straps of different species are nearly identical, making it necessary to have males to identify the species.

Abedus (Deinostoma) dilatatus (Say)

(Pls. 57, 58; figs. 6, a-b, 15, a-b, 25, 28, 44)

- Belostoma dilatata* Say, 1832, Descriptions of new species of Heteropterous Hemiptera (Fitch Reprint: 1858, Trans. New York State Agr. Soc., 17:810).
- Serphus dilatatus*, Stål, 1862, Ent. Zeitung, 23(10-12):462; Dufour, 1863, Ann. Soc. Ent. France, 32:395 (desc.); Mayr, 1871, Verh. K. K. Zool.-Bot. Ges. Wien, 21:403 (key and listed); Uhler, 1875 (in part), Bull. U. S. Geol. Geog. Surv. Terr., 1:338 (listed).
- Deinostoma dilatatum*, Kirkaldy, 1897, Entomologist, 30:259 (listed); Champion, 1901, Biol. Cent.-Amer., 2:362 (listed).
- Abedus dilatata*, Montandon, 1903, Bul. Soc. Sci. Buc., 12(1-2):113 (listed); Kirkaldy, 1906, Trans. Amer. Ent. Soc., 32(2):151 (listed).
- Abedus dilatatus*, Kirkaldy and Bueno, 1909 (in part), Proc. Ent. Soc. Wash., 10(3-4):189 (cat.); Van Duzee, 1917 (in part), Cat. Hem. Amer. No. Mexico, p. 470 (cat.); Hidalgo, 1935, Univ. Kans. Sci. Bull., 22:502-503 (rev.); De Carlo, 1938, Anal. Mus. Arg. Cienc. Nat., 39:244 (listed); De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:22-23 (rev.); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:70 (listed).
- Zaitha stollii* Herrich-Schaffer (nec Amyot and Serville), 1853, Die Wanz. Insecten, 9:35.
- Abedus montandoni* De Carlo, 1932, Rev. Soc. Ent. Arg., 22:121-123 (new synonymy); Hidalgo, 1935, Univ. Kans. Sci. Bull., 22:504-505 (rev.); De Carlo, 1938, Anal. Mus. Arg. Cienc. Nat., 39:245 (listed); De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:16-17 (rev.); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:70 (listed).

Abedus anconai De Carlo, 1938, Rev. Soc. Ent. Arg., 10(1):43-45 (new synonymy); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:70 (listed).

Size: Length, 25.5-34 mm.; width, 13-17.5 mm.

Head: Eye flattened externally, exterior margin at anterior angle perpendicular to longitudinal axis of head or very slightly recurved, when viewing head with longitudinal axis horizontal; longitudinal sulcus mesad of each eye rather uniformly shallow, not broadened into a large depression at apical third of eye, interocular space between sulci uniformly convex; eye as high as interocular space; width of eye equal to or slightly greater than one-half interocular distance; clypeus usually not prominent, head evenly arcuate from vertex to apex of clypeus; length of tylus three-fourths to four-fifths the length of eye; antenna usually 3-segmented, II bearing commonly only a tubercle or short tooth, III usually devoid of any process but occasionally with a short tubercle or finger (figs. 6, a, b).

Metasternum: Keeled basally, keel gradually reduced toward apex, finally disappearing at a point between posterolateral angles of metasternum.

Hemelytron: Greatest width of membrane and translucent margin combined equal to or slightly greater than median length of posterior lobe of pronotum; margin of apex of hemelytron evenly rounded or more rarely somewhat flattened; hemelytron usually covered with many irregular dark brown spots (pls. 57, 58).

Ventral laterotergites: Last ventral laterotergite very narrowly glabrous along mesal margin beyond genital plate.

Air strap: Basal half of lobe of male strap with a large circular depression dorsally in which are situated one or more ripples which do not form a complete sac; mesal margin of strap opposite depression expanded; patch of long hairs on apical half of lobe broadest near lateral margin of strap (fig. 15, a); female strap without dorsal depression or ripples, covered with long hairs which are thickest along mesal margin; strap dorsally at about mid-point with a small circular area denoted by sparser and flatter pubescence (fig. 15, b).

Phallus: Opening of ejaculatory duct dorsal; lateral wing short, curved throughout length (figs. 25, 28).

The antennae will be found to vary in different localities. The commonest type has only a tooth on segment II and none on segment III. In larger specimens the process on the second segment may be more fingerlike, and the third segment may bear a small prolongation as in figure 6, b. The ripples in the dorsal depression vary in number and shape. The pattern of hair below the depression is rather constant in shape but the hairs themselves may vary from short stout spines to long thin hairs, especially near the mesal margin of the strap. The amount of hair on the female strap varies, as does the shape of the strap.

This species resembles the other members of the subgenus very closely but can be separated from them by the combination of characters presented by the phallus and male air strap. The females of this species will be difficult to determine without males. The females of *herberti*, *immensus*, and *decarloi* have a very similar air strap. The straps of the females of *stangei* and *indentatus* are distinct from *dilatatus*. *Dilatatus* does occur in the same streams with *immensus* and in these cases the females will be very difficult to identify. However, this species is generally narrow in appearance and averages about 29 or 30 mm. in length whereas *immensus* is broad and averages much larger.

Zaitha stollii Herrich-Schaffer is not the same as *Zaitha stollii* of Amyot and Serville (1843), which is a *Belostoma*. From Herrich-Schaffer's description it is obvious that he was describing an *Abedus*. Stål (1862) synonymized *stollii* with *dilatatus* and it seems best to follow his opinion. *Abedus montandoni* and *Abedus anconai* are definitely synonyms of *dilatatus*. I have seen two of Dr. De Carlo's

paratypes of *montandoni*, and the air straps and phallus are clearly that of *dilatatus* (UK, AM). *A. anconai* was described from the same locality as *montandoni* (Zinacantepec, México), and the antennal differences given by Dr. De Carlo to separate the two fall within the range of variation of *dilatatus*. I have personally collected at the type locality (Zinacantepec is about 3 miles W. of Toluca in the state of México) and have found that all the specimens are *dilatatus*.

Types.—The original specimen or specimens on which Say's species was based were destroyed or lost, as was most of his early material. His description is brief and not definite enough to pin down the species accurately. The only facts given by Say that are of help are that the size was "one inch and one tenth," and "venter tinged with rufous." He cited the type locality as being between Jalapa and Vera Cruz, México. I have seen three species from that area: *signoreti*, *ovatus*, and *stangei*. *A. stangei* has a reddish venter but is larger than Say's measurement. *A. signoreti* and *ovatus* rarely have a reddish venter, but occasional large specimens of these two fit Say's measurement. He could have had any one of these three species before him. I suspect, however, that he had none of the three. A fourth species, which I have here called *dilatatus*, does fit Say's description better than any of the three previously mentioned species. The average size of this species agrees with his measurement. This species is also commonly reddish on the abdominal venter. In addition, this is the same species that Stål (1862), Mayr (1871), and Champion (1901) considered as *dilatatus*. It seems most logical therefore to retain Say's name for this species although I have not seen specimens from between Jalapa and Vera Cruz. Further collecting may turn up specimens from the type area since this species is widespread in México, and I have seen it taken less than 100 miles from Jalapa. I am selecting a male specimen collected 8 miles NW. of Huejotzingo, Puebla, México, December 27, 1958, by A. Menke and L. Stange, for neotype designation. A neallotype and 25 neoparatypes will be selected from the same series as the type. The neotype and neallotypes will be deposited in the Los Angeles County Museum. Neoparatypes will be distributed to the following institutions and private collections: California Academy of Sciences; University of Arizona; University of Kansas; Philadelphia Academy of Sciences; University of Michigan; U. S. National Museum; American Museum of Natural History; Robert L. Usinger collection; David R. Lauck collection; and my own collection. The specimens were collected in a narrow drainage ditch along the side of highway 190.

Distribution (fig. 44).—This species seems to be restricted to the high central plateau of México. I have seen specimens from the region of México City and as far north as northern Chihuahua. Reports in the literature of *dilatatus* from California are undoubtedly misidentifications. I suspect that further collecting in New Mexico and Arizona may reveal its presence there. Records of *macronyx* from México by Uhler and Champion probably refer to this species.

Material examined (306 specimens).—MEXICO. AGUASCALIENTES: Arroyo San Pedro, 38 mi. N. Aguascalientes, Dec. 24, 1958, A. Menke and L. Stange, 3 ♂♂, 2 ♀♀ (AM). CHIHUAHUA: Ciudad Camargo, July 26, 1953, ♀ (UK); El Valle, ♂ (Pomona); 24 mi. S. Hidalgo del Parral, Dec. 23, 1958, A. Menke and L. Stange, ♀ (AM); La Junta, June 26, 1953, A. Flechsig, ♂ (RLU); Ojo de Sanguijuela, 42 mi. SE. Nueva Casas Grandes, Aug. 14, 1952, J. Lattin, 6 ♂♂, 4 ♀♀ (CIS); Primavera, June 30, 1947, Gertsch, 2 ♂♂, ♀ (AMNH); Sombreretillo, June 29,

1956, R. Allen, ♀ (CIS). DURANGO: 35 mi. SW. El Salto, July 23, 1953, 14 ♂♂, 14 ♀♀ (UK); Encino, July 27, 1947, G. Bradt, 2 ♂♂ (AMNH); Nombre de Dios, Dec. 24, 1958, A. Menke and L. Stange, 6 ♂♂, 4 ♀♀ (AM); 30 mi. NW. Otinapa, July 12, 1952, J. Lattin, ♂, ♀ (CIS); Rio Santiago, 11 mi. E. Durango, July 9, 1952, J. Lattin, ♂ (CIS); 15 mi. W. Verdo, Nazas River, Aug. 20-26, 1946, ♂ (USNM). GUANAJUATO: Puente la Cebada, June 20, 1957, D. Lauck and W. Wheatcroft, 9 ♂♂, 7 ♀♀ (DRL); 10 mi. SE. Silao, Dec. 25, 1958, A. Menke and L. Stange, 11 ♂♂, 11 ♀♀ (AM). HIDALGO: Ixmiquilpán, June 23, 1953, ♂ (UK); Huichapán, Dec. 25, 1958,

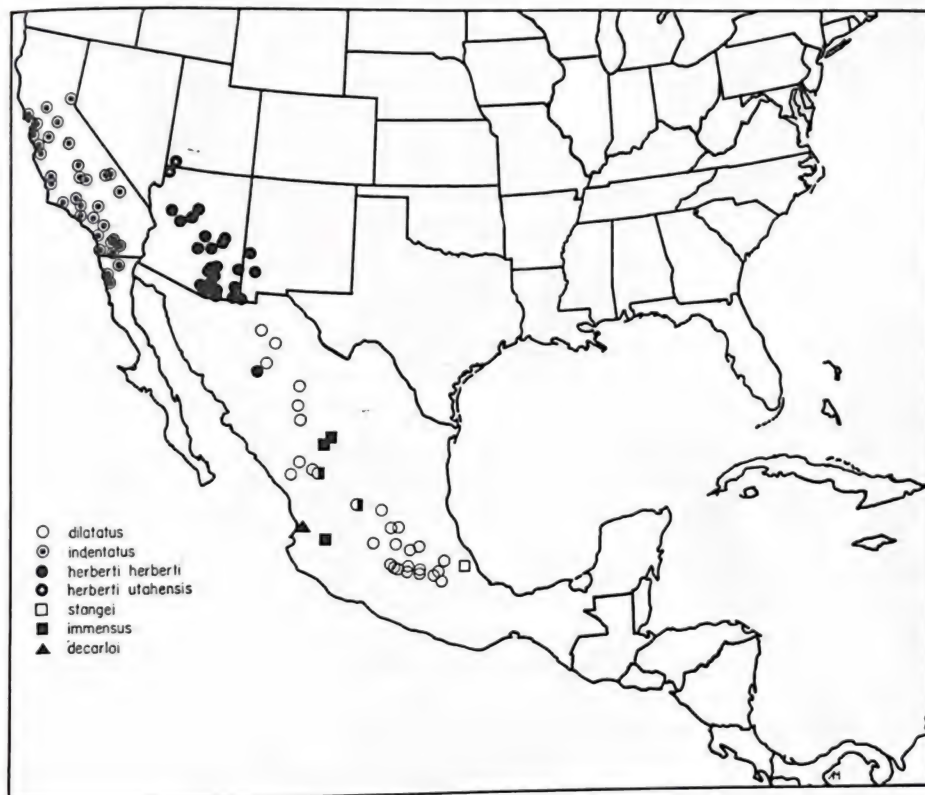


Fig. 44. Distribution map for *A. dilatatus*, *indentatus*, *herberti* s.l., *stangei*, *immensus*, and *decarloi*.

A. Menke and L. Stange, 20 ♂♂, 31 ♀♀ (AM). MÉXICO: Distrito Federal, 1933, Aneona, ♂, ♀ (RLU); L. Conradt, ♀ (USNM); Ixtlahuaca, June 21, 1957, D. Lauck and W. Wheatcroft, 2 ♂♂, 4 ♀♀ (DRL); Lake Xochimilco, March 2, 1932, Dildine and Turner, ♀ (UMMZ); Rio Salitre and highway 15, Dec. 28, 1958, A. Menke and L. Stange, 5 ♂♂, 14 ♀♀ (AM); Toluca, Aug. 9, 1957, D. Lauck and W. Wheatcroft, 2 ♀♀ (DRL); 3 mi. W. Toluca, Dec. 28, 1958, A. Menke and L. Stange, 4 ♂♂, 5 ♀♀ (AM); Zinacantepec, ♀ (UK). MICHOACÁN: Cerro San Andrés, 11 mi. WNW. Ciudad Hidalgo, March 21, 1949, J. Peters, ♂ (UMMZ); Zitacuaro, Aug. 5, 1932, H. Smith, ♂ (UK); Aug. 9, 1957, D. Lauck and W. Wheatcroft, 2 ♂♂, 4 ♀♀ (DRL). PUEBLA: Chiguahuapán, ♀ (USNM); 8 mi. NW. Huejotzingo, Dec. 27, 1958, A. Menke and L. Stange, 24 ♂♂, 38 ♀♀ (neotype series) (AM); Puebla, July 29, 1937, H. Thomas, ♂ (UK). QUERETARO: Santa Catarina, June 20, 1957, D. Lauck and W. Wheatcroft, 13 ♂♂, 14 ♀♀ (DRL). SAN LUIS POTOSÍ: 2 mi. S. San Luis Potosí, Nov. 21, 1948, H. Leech, ♀ (CAS). TLAXCALA: Tlaxcala, June 25, 1957, D. Lauck and W. Wheatcroft, 3 ♂♂, 5 ♀♀ (DRL).

Abedus (Deinostoma) herberti Hidalgo, sensu lato

(Figs. 7, a-d, 13, a-b, 24, 34, 44)

This species is the most variable of the subgenus *Deinostoma*. It can be divided into two distinct subspecies.

Size: Length, 24.5-40 mm.; width, 12.5-22 mm.

Head: Eye flattened externally, exterior margin at anterior angle perpendicular to longitudinal axis of head or very slightly recurved, when viewing head with longitudinal axis horizontal; longitudinal sulcus mesad of each eye broadened into a large depression at apical third of eye, causing a slight depression posterior to base of clypeus when viewing dorsal curvature of head laterally; eye as high as interocular space or slightly higher; width of eye equal to or slightly less than one-half width of interocular distance; clypeus often prominent basally owing to the joining of two large depressions, head usually not evenly arcuate from vertex to apex of clypeus; length of tylus three-fourths to four-fifths eye length; antenna 2- to 4-segmented, segment II bearing a tooth or a long finger, segment III having no tooth or with a fingerlike process (fig. 7, a-d).

Metasternum: Keeled basally although rather rounded, keel gradually disappearing toward apex at point between posterolateral angles of metasternum.

Hemelytron: Greatest width of membrane and translucent margin combined equal to or slightly greater than median length of posterior lobe or pronotum; margin of apex of hemelytron flattened or broadly emarginate, rarely evenly rounded; hemelytron rather uniform in color.

Ventral laterotergites: Hairs of last plate long until apical fourth where they gradually shorten into stout spines.

Air strap: Basal half of lobe of male strap with a large circular depression dorsally in which are usually situated one or more ripples which do not form a complete sac (one subspecies typically without ripples); mesal margin of strap opposite depression slightly expanded; patch of long hairs on apical half of lobe broadest near mesal margin of strap (fig. 13, a); female strap without dorsal depression or ripples, covered with long hairs which are thickest near mesal margin; strap dorsally at about mid-point with a small circular area denoted by sparser and flatter pubescence (fig. 13, b).

Phallus: Opening of ejaculatory duct on downward sloping face of apex of phallus; lateral wing long and straight for basal half but curving downward near apex; anteroventral area medianly depressed (figs. 24, 34).

The depression on the head may be almost absent in some specimens, and there will be no depression posterior to the base of the clypeus in these forms. In occasional specimens the eye may be slightly lower than the interocular space. The antennae are commonly three-segmented. Occasionally the third segment may be partly divided into a fourth or there may be four distinct segments. Rarely the segments are fused forming only a two-segmented antenna. The air straps of both sexes vary in general shape and appearance, some being broad, others rather narrow apically. The typical subspecies has ripples on the male strap whereas the other subspecies, *utahensis*, typically is devoid of ripples. This species exhibits the greatest range in size of any of the species studied. The average length of the typical subspecies is 32 mm. or more.

This species is very closely related to *A. immensus* but the presence of the sac on the male strap of *immensus* will separate it from *herberti*. The phallus of the two species is very similar as can be seen by examining figures 22 and 24. The phallus of *indentatus* is nearly identical with *herberti*, but the air straps of these two species are quite different. The combined characters of the male air strap and

phallus will separate this species from the others of the subgenus. It will be difficult to determine females if no males are present since the female straps of *dilatatus*, *decarloi*, and *immensus* are very similar.

Distribution (fig. 44).—*Abedus herberti* is found primarily in the United States. It is widely distributed in Arizona, ranges into western New Mexico, and is found also in southern Utah in the Colorado River drainage system. It extends into northern México but I have not had sufficient material to determine its distribution there. The typical form, *herberti herberti*, is by far the commoner of the two subspecies and has a much greater range. The following key will serve to differentiate the two subspecies:

1. Male air strap with definite ripples in dorsal depression; average size 32 mm. or more; Arizona (south of Colorado River), New Mexico, Texas†, and northern México

Abedus herberti herberti Hidalgo

Male air strap without a trace of a ripple in dorsal depression; size small, 27 mm. long or less; southwest Utah and Arizona north of Colorado River

Abedus herberti utahensis Menke, n. subsp.

Abedus (Deinostoma) herberti herberti Hidalgo

(Figs. 7, b-d, 13, a-b, 19, 44)

Abedus herberti Hidalgo, 1935, Univ. Kans. Sci. Bull., 22:507-508 (♂, ♀); De Carlo, 1938, Anal. Mus. Arg. Cienc. Nat., 39:247 (desc.); De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:15 (rev.); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:70 (listed).

Abedus drakei De Carlo, 1938, Rev. Soc. Ent. Arg., 10(1):41-43 (♂, ♀) (new synonymy); De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:19 (rev.); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:70 (listed).

Abedus stali De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:21-22 (♀) (new synonymy); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:70 (listed).

The following citations probably refer to this species:

- Pedinocoris brachonyx*, Uhler, 1886 (in part), Checkl. Hem. Het. No. Amer., p. 28 (checklist); Uhler, 1877, Ann. Rept. Geog. Surv. W. 100th Merid. App. NN, p. 1331 (listed); Kirkaldy, 1898, Entomologist, 31:2-3 (nymph desc.); Banks, 1910 (in part), Cat. Neare. Hem. Het., p. 8 (cat.).
- Abedus macronyx*, Kirkaldy and Bueno, 1909 (in part), Proc. Ent. Soc. Wash., 10(3-4):189 (cat.); Van Duzee, 1917 (in part), Cat. Hemip. Amer. No. Mexico, p. 471 (cat.); Hidalgo, 1935, Univ. Kans. Sci. Bull., 22:503-504 (rev.); De Carlo, 1938, Anal. Mus. Arg. Cienc. Nat., 39:244-245 (desc.); De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:21 (rev.).
- Serphus dilatatus*, Uhler, 1875 (in part), Bull. U. S. Geol. Geog. Surv. Terr., 1:338 (listed); Uhler, 1886 (in part), Checkl. Hem. Het. No. Amer., p. 28 (checklist).
- Abedus dilatatus*, Kirkaldy and Bueno, 1909 (in part), Proc. Ent. Soc. Wash., 10(3-4):189 (cat.); Van Duzee, 1917 (in part), Cat. Hemip. No. Mexico, p. 470 (cat.).
- Abedus identata* (!), Kirkaldy and Bueno, 1909 (in part), Proc. Ent. Soc. Wash., 10(3-4):189 (cat.).
- Pedinocoris identata* (!), Banks, 1910 (in part), Cat. Neare. Hem. Het., p. 8 (cat.).
- Abedus indentatus*, Van Duzee, 1917 (in part), Cat. Hemip. Amer. No. Mexico, p. 471 (cat.); Hidalgo, 1935, Univ. Kans. Sci. Bull., 36(8):506-507 (rev.); De Carlo, 1938, Anal. Mus. Arg. Cienc. Nat., 39:246 (desc.); De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:14 (rev.).
- Abedus hungerfordi*, Hidalgo, 1935 (in part), Univ. Kans. Sci. Bull., 22:505-506 (rev.).
- Abedus montandoni*, Hidalgo, 1935 (in part), Univ. Kans. Sci. Bull., 22:504-505 (rev.).
- Size: Length, 24.5-40 mm.; width, 14-22 mm.

Diagnostic features: Air strap of male with one or more ripples in circular dorsal depression (fig. 13, a); segment II of antenna usually bearing a long fingerlike process (figs. 7, b-d, 19); average length 32 mm. or more.

The variation mentioned under the species applies mainly to this subspecies.

Abedus herberti herberti is easily separated from *utahensis* by the characters in the key of subspecies. It resembles *immensus* very closely. They are about the same size and of the same general appearance. The phalli of the two differ very slightly, and the air strap of the male is the only reliable means of separating them. The females without males will be difficult to separate.

This species has been much confused with others of the genus as attested by the lengthy synonymy. Hidalgo was the first to recognize it as a distinct species, but even so, he cited other specimens of *herberti herberti* from Arizona as *hungerfordi* (= *indentatus*). *A. drakei* and *stali* De Carlo are plainly synonyms of *herberti* s.s. The specimens on which Dr. De Carlo based his descriptions were collected in Ramsey Canyon in the Huachuca Mountains of southern Arizona, according to Dr. Carl J. Drake (personal correspondence) who sent the material to Dr. De Carlo. I have seen paratypes of both of Dr. De Carlo's species, and I am convinced that they are not valid (UK, CJD). They agree with the characters of *herberti*, and the characters given by Dr. De Carlo to separate his two species fall within the range of variation found in *herberti* s.s. I have collected in Ramsey Canyon and at many other points along the Huachuca Mountains and have found only *herberti*.

Type.—The holotype of *herberti* is in the Snow Entomological Collection at the University of Kansas. Through the courtesy of Dr. H. B. Hungerford and Dr. George W. Byers I have been able to examine the type of this species. It is a male and was collected at Tucson, Arizona, by F. H. Snow. The antenna is three-segmented, bears a small tooth on the second segment and a short finger on the third segment.

Distribution (fig. 44).—This subspecies ranges from northern México into and including most of Arizona south of the Colorado River. It is found also in western New Mexico and perhaps in Texas. I have seen one specimen labeled "Tex" and another labeled "Col" (USNM). There is a specimen in the Philadelphia Academy of Sciences labeled from Rabun Bald, Georgia. This is certainly an error in labeling. There does not seem to be an area of overlap between the two subspecies of *herberti* since the Colorado River apparently forms a natural barrier between them.

Material examined (228 specimens).—UNITED STATES. ARIZONA: Cochise Co.: Bear Canyon, Huachuca Mts., Nov. 5, 1953, F. Truxal and L. Martin, 5 ♀♀ (LACM); Sept. 8, 1958, A. Menke and L. Stange, 3 ♂♂, 4 ♀♀ (AM); Cave Creek, Chiricahua Mts., July, 1927, J. Kutsche, ♂ (CAS); Nov. 7, 1953, F. Truxal and L. Martin, ♂ (LACM); June 18, 1958, J. and S. Burns, ♀ (CIS); Chiricahua Mts., June, H. Hubbard, ♂ (USNM); April 7, 1944, M. Frost, Jr., ♂, 3 ♀♀ (UA); May 2, 1958, E. Gould, ♂, ♀ (UA); Huachuca Canyon, Huachuca Mts., July 3, 1950, R. Langston, ♀ (LACM); Huachuca Mts., ♀ (CAS); May 5–June 24, 1919, R. Camp, 4 ♂♂, 6 ♀♀ (UMMZ); Hunters Canyon, Huachuca Mts., June 3, 1908, C. Biedermann, ♀ (USNM); 6 mi. W. Montezuma Pass, Huachuca Mts., Sept. 6, 1955, G. Butler and F. Werner, ♂ (UA); Painted Canyon ranch, Chiricahua Mts., June 20, 1954, M. Cazier, ♂ (AMNH); Palmerly, Huachuca

Mts., ♂ (USNM); Portal, March 3, 1958, R. Johnson, ♀ (UA); May 3, 1958, Edgerton, ♂ (AM); 5 mi. W. Portal, July 4, 1956, D. Westfall, ♀ (AMNH); Aug. 12-25, 1958, P. Marsh, R. James, and D. Linsdale, ♂, 2 ♀♀ (UCD); Aug. 22, 1958, P. Hurd, 2 ♀♀ (CIS); Ramsey Canyon, Huachuca Mts., Sept. 8, 1958, A. Menke and L. Stange, 4 ♂♂, 4 ♀♀ (AM); Rucker Canyon, July 14, 1939, Miller and Davis, ♂ (UMMZ); San Bernardino Ranch, Nov. 6, 1953, F. Truxal and L. Martin, ♀ (LACM); April 1, 1958, A. Menke and L. Stange, 13 ♂♂, 27 ♀♀ (AM). Coconino Co.: Manzanita Camp, Oak Creek Canyon, July 26, 1950, T. Cohn *et al.*, ♀ (AMNH); Oak Creek Canyon, July 9, 1941, B. Hodgden, ♀ (UK); Williams, July 4, 1940, B. Knudsen, ♀ (UA). Gila Co.: Globe, June 15, 1925, C. Alden, ♂ (UMMZ); East Verde River, 7 mi. N. Payson, Sept. 11, 1958, A. Menke and L. Stange, 3 ♀♀ (AM); Sixshooter Canyon nr. Globe, Aug. 17, 1958, L. Stange, 2 ♂♂, 2 ♀♀ (AM); Sept. 11, 1958, A. Menke and L. Stange, 2 ♂♂, ♀ (AM); Sycamore Forest Camp, 7 mi. N. Payson, Aug. 13, 1950, T. Cohn *et al.*, 2 ♂♂ (AMNH). Greenlee Co.: Clifton, ♀ (LACM). Maricopa Co.: S. R. V. Exp. Farm., Mesa, Nov. 11, 1926, ♂ (UA). Mohave Co.: Trout Creek nr. jct. Big Sandy River, April 8, 1950, ♀ (UMMZ); Trout Creek 16 mi. N. Wikieup, April 1, 1959, A. Menke and P. Marsh, ♂, 3 ♀♀ (AM). Navajo Co.: Lakeside, Aug. 22, 1952, B. Malkin, ♂ (CAS); 8-15 mi. NE. Whiteriver, July 8-11, 1940, Gertsch and Hook, ♀ (AMNH). Pima Co.: Arivaca, June 17, 1934, L. Wehrle, ♀ (UA); Catalina Mts., Sept. 25, 1924, A. Nichol, ♂ (UA); Nov. 8, 1934, M. Perkins, ♂ (UA); Oct. 23, 1941, V. Potter, 2 ♀♀ (UMMZ); July 17, 1957, C. O'Brien, ♂ (CIS); Lowell Ranger Station, July 6-20, 1916, ♀ (AMNH); Madera Canyon, Santa Rita Mts., April 2-4, 1953, F. Truxal and L. Martin, ♂, ♀ (LACM); Sept. 1-2, 1954, A. Menke and L. Stange, 2 ♀♀ (AM); June 6, 1956, A. Menke, ♀ (AM); July 10, 1957, L. Stange and W. Harding, ♂, 2 ♀♀ (AM); Manning Camp, Rincon Mts., June 26, 1932, 5 ♂♂ (SDM); Redington, D. Barnes, 2 ♀♀ (USNM); Sabino Basin, Catalina Mts., July 8-20, 1918, ♀ (AMNH); Sabino Canyon, Catalina Mts., July 29, 1937, E. Ball, ♂ (UA); July 31, 1941, R. Beamer, ♀ (UK); July 7, 1950, J. Rogen, ♂ (UK); Dec. 28, 1950, R. Beal, ♂ (RLU); Oct. 10, 1955, F. Truxal and L. Martin, 3 ♀♀ (LACM); May 5, 1958, D. McDaniel, 4 ♀♀ (UA); Santa Cruz River, Tucson, March 24, 1912, J. Slevin, ♀ (CAS); Santa Rita Mts., Nov. 16, 1924, A. Nichol, ♀ (UA); July 24, 1927, R. Beamer, ♂ (UK); April 24, 1934, M. Frost, Jr., ♂ (UA); June 20, 1936, P. Blossom, ♂ (UMMZ); Aug. 1, 1941, R. Beamer and R. Hodgden, ♂, 3 ♀♀ (UK); July 10, 1952, R. and L. Beamer, ♀ (UK); Tanque Verde Mt., Oct. 13, 1940, G. Smith, 2 ♂♂ (UA); Tucson, Nov. 13, 1916, ♀ (UA); Nov. 11, 1924, ♀ (UA); July 1-8, 1925, C. Vorhies, ♀ (UA); May 10, 1952, R. Jantzen, ♂ (UA); May 2, 1955, Renn, ♀ (UA); Oct. 10, 1955, F. Truxal and L. Martin, ♀ (LACM); White House Canyon, Santa Rita Mts., Sept. 1934, O. Bryant, ♀ (CAS). Santa Cruz Co.: Bear Valley, Tumacacori Mts., Aug. 22, 1949, ♀ (UA); Canelo, Oct. 20, 1943, J. Hendrickson, ♂ (UA); Oro Blanco Mts., nr. Nogales, July, 1937, P. Steckler, 2 ♂♂ (AMNH); Patagonia, July, 1936, E. Ross, ♀ (CAS); Aug. 16, 1937, H. Harris, ♂, ♀ (UI); Sept. 6, 1938, C. Hubbs, 2 ♀♀ (UMMZ); Ruby, Oct. 29, 1939, H. Drummond, ♀ (UA); July 13, 1940, L. Kuitert, ♂, ♀ (UK); Sonoita River, 18 mi. N. Nogales, April 28, 1955, ♂ (UA); Sycamore Canyon, Sept. 8, 1958, A. Menke and L. Stange, 4 ♂♂, 7 ♀♀ (AM). Yavapai Co.: Prescott, C. Olsen, ♂ (AMNH); Aug. 13, 1937, H. Harris, ♀ (UI); Santa Maria River and Highway 93, April 1, 1959, A. Menke, 2 ♀♀ (AM). New Mexico: Catron Co.: Mineral Creek, Mogollon Mts., 1913, N. Emerick, ♂ (USNM); Whitewater Box Canyon, 6 mi. E. Glenwood, July 17, 1939, R. Miller and J. Davis, ♀ (UMMZ). Grant Co.: Big Dry Creek, Sept. 10, 1933, H. Gentry, ♂ (CAS); Silver City, July 22, 1936, M. Jackson, ♂ (UK). Hidalgo Co.: Gray Ranch, Cloverdale, July 21, 1939, Miller and Davis, ♂ (UMMZ).

MEXICO. CHIHUAHUA: Arroyo a la Rana, 10 mi. S. El Vergel (La Laguna), Aug. 9, 1952, J. Lattin, 4 ♂♂ (CIS); Arroyo Agua Caliente, 15 mi. S. El Vergel (La Laguna), Aug. 10, 1952, J. Lattin, 5 ♂♂, 11 ♀♀ (CIS). SONORA: "Sonora," C. Lumholtz, ♂, ♀ (AMNH).

***Abedus* (*Deinostoma*) *herberti utahensis* Menke, n. subsp.**

(Figs. 7, a, 44)

Size: Length, 25-26.5 mm.; width, 12.5-14 mm.

Diagnostic features: Air strap of male usually without trace of a ripple in circular depression on dorsal surface; antenna usually 3-segmented, without projection from segment II.

No significant variation has been observed except that the second segment of the antenna may occasionally bear a tooth or tubercle.

This subspecies is not likely to be confused with any other species in the genus for no other species occurs within its rather restricted habitat. It is separated from *herberti* s.s. by the characters mentioned above. This subspecies does not possess the broad depressions mesad of the eye as in the typical subspecies. The form of *utahensis* is narrow and it is much smaller than the typical subspecies.

Abedus herberti utahensis has previously been known as *Abedus dilatatus* (Hidalgo, 1935). True *dilatatus* is similar in size and appearance, but the air straps and the phallus of the two are very different.

Types.—Holotype male, allotype female and 3 paratypes: Saint George, Utah, Dec. 6, 1940, H. P. Chandler; 7 paratypes: Saint George, Utah, L. A. Woodbury (no date); 1 paratype: Saint George, Utah, A. M. Woodbury (no date); 2 paratypes: Saint George, Utah, Feb., 1921, V. M. Tanner; 1 paratype: Saint George, Utah, Aug., 1925, V. M. Tanner; 1 paratype: Saint George, Utah, Dec., 1925, V. M. Tanner; 3 paratypes: Beaver Dam Creek tributary to Virgin River, Mohave Co., Arizona, July 28, 1942, Carl L. Hubbs. The holotype, allotype, and several paratypes will be deposited in the California Academy of Sciences. Additional paratypes will be deposited in the following collections: University of Utah, American Museum of Natural History, University of Michigan Museum of Zoology, University of Kansas, Robert L. Usinger collection and my own collection.

Distribution (fig. 44).—Known only from the types. This subspecies seems restricted to the Virgin River and its tributaries. It probably will be found only north of the Colorado River which apparently serves as a natural barrier between the two subspecies of *herberti*.

***Abedus (Deinostoma) immensus* Menke, n. sp.**

(Figs. 12, a-b, 19, 22, 35, 44)

Male.—Length, 35–39 mm.; width, 19–21.5 mm.

Head: Eye somewhat flattened externally, exterior margin at anterior angle perpendicular to longitudinal axis of head or very slightly recurved, when viewing head with longitudinal axis horizontal; longitudinal sulcus mesad of each eye deep throughout its length, somewhat broadened into a large depression at apical third of eye; eye as high as interocular space or higher; width of eye about equal to one-half width of interocular distance; clypeus usually not prominent, head evenly arcuate from vertex to apex of clypeus; length of tylus about four-fifths length of eye; antenna usually 3-segmented, with a long finger on segment II and no projection on III; when 4-segmented, segment III bears a finger (fig. 19).

Metasternum: Roundly keeled basally, keel gradually reduced toward apex and finally disappearing between posterolateral angles of metasternum, apex flattened.

Hemelytron: Greatest width of membrane and translucent border combined equal to or slightly greater than median length of posterior lobe of pronotum. Apex of hemelytron usually rounded but sometimes broadly emarginate.

Ventral laterotergites: Dense pubescence covering only basal two-thirds of last plate, the remainder sparsely covered with stout spines.

Air strap: Basal half of lobe devoid of long dense hairs but with a small, well-formed sac dorsally; mesal margin of lobe slightly expanded for most of its length; apical half of lobe with a narrow diagonal patch of hairs which broadens toward mesal margin (fig. 12, a).

Phallus: Opening of ejaculatory duct on downward sloping apical face of phallus; lateral wing long and straight basally but curving downward apically (figs. 22, 35).

Female.—Same as male except as follows: greatest width 22 mm.; width of membrane always

greater than median length of posterior lobe of pronotum, sometimes nearly twice its median length; antenna 3-segmented with prolongations from both II and III; air strap without a dorsal sac, pubescence densest along mesal margin; strap broadest at apex (fig. 12, b).

Except for the variation mentioned in the description the species is rather constant in form.

This species of *Deinostoma* is unique in having a sac on the dorsal side of the male strap. The average size is greater than that in any other member of the genus. *A. herberti herberti* approaches *immensus* in size and has a very similar phallus. Although *immensus* seems distinct enough at present, more material from northern México may reveal it to be only a subspecies of *herberti*. *A. immensus* and *dilatatus* have been found together in some streams, and the females in these situations may be difficult to determine since the straps are similar.

Types.—Holotype male, allotype female and 5 paratypes: Santa Cruz Astillero, Jalisco, México, Dec. 30, 1958, Arnold Menke and Lionel Stange. Nine additional paratypes as follows: Arroyo San Pedro, 38 mi. N. Aguascalientes, Aguascalientes, México, Dec. 24, 1958, A. Menke and L. Stange, 1 male; 20 mi. E. Las Adjuntas, Durango, México, June 30, 1952, J. D. Lattin, 2 males and 2 females; Las Adjuntas, Durango, México, July 1, 1952, J. D. Lattin, three females; Nombre de Dios, Durango, México, Dec. 24, 1958, A. Menke and L. Stange, one male. The holotype and allotype will be deposited in the Los Angeles County Museum. Paratypes will be deposited in the museum of the California Insect Survey, University of Kansas, and my own collection.

Distribution (fig. 44).—In addition to the types, I have seen one male from Torreon, Coahuila, México, June 15, 1937, M. Embury (UK).

***Abedus (Deinostoma) decarloi* Menke, n. sp.**

(Figs. 14, 17, 36, 44)

Male.—Length, 30–32.5 mm.; width, 16–17.5 mm.

Head: Eye somewhat flattened externally, exterior margin at anterior angle perpendicular to longitudinal axis of head when viewing it with longitudinal axis horizontal; longitudinal sulcus mesad of each eye deep anteriorly and broadening into a large depression at about apical third of eye; eye higher than interocular space; width of eye about equal to one-half width of interocular distance; clypeus usually not prominent, head from vertex to apex of clypeus evenly arcuate; length of tylus about four-fifths length of eye; antenna 3-segmented with a short fingerlike process on segment II and occasionally a short finger on III.

Metasternum: Keel poorly developed, rounded, disappearing between posterolateral angles of metasternum, sides of apex reflexed upward forming a V- or Y-shaped gutter.

Hemelytron: Greatest width of membrane and translucent border combined slightly greater than median length of posterior lobe of pronotum; embolium broad at base; apex of hemelytron slightly flattened.

Ventral laterotergites: Dense pubescence covering only basal two-thirds of last plate, remainder sparsely covered with stout spines which grade into longer hair at basal two-thirds.

Air strap: Basal half of lobe with a dorsal circular depression in which are situated one or more longitudinal ripples or folds, apical half of strap with a triangular patch of long hairs (fig. 14).

Phallus: Opening of ejaculatory duct situated low on downward sloping apical face of phallus, somewhat triangular in shape with venterolateral angles slightly emarginate; lateral wing not well developed, not broadened apically, sides of phallus nearly parallel when viewed dorsally (figs. 17, 36).

Female.—Same as male except as follows: antenna 4-segmented with a long fingerlike process on segments II and III; greatest width of membrane and translucent border combined one and

a half times median length of posterior lobe of pronotum, embolium not broad basally; air strap without a dorsal circular depression or ripples, pubescence densest along mesal margin.

The clypeus may be prominent in some specimens, and the broad depressions mesad of each eye may be rather poorly developed.

Abedus decarloi most closely resembles *A. herberti*, especially in the air strap of both sexes. The phallus of *decarloi*, however, is unlike anything else in the genus and will separate the species from *herberti* and any other *Abedus*. Without males, the female of this species will be very difficult to separate from *herberti*, *dilatatus*, and *immensus*. The female straps of these species are all very similar.

Types.—Holotype male: Vicinity of Compostela, Nayarit, México, June 1-7, 1934, collector unknown; allotype female and 5 paratypes as follows: Compostela, Nayarit, México, April 20, 1933, collector unknown (allotype); April 20, 1933, one male; vicinity of Compostela, June 24, 1933, one male; May 15, 1933, one male; June 10, 1933, one female; Nayarit, México, Aug. 22, 1936, one male. Holotype, allotype, and 3 paratypes deposited in the Snow Entomological Collections at the University of Kansas, one paratype in the Los Angeles County Museum, and one paratype in my collection.

This species is dedicated to Dr. Jose A. De Carlo, who has made many contributions to belostomatid taxonomy.

Distribution (fig. 44).—Known only from the types.

***Abedus (Deinostoma) stangei* Menke, n. sp.**

(Figs. 9, a-b, 19, 27, 44)

Male.—Length, 29-30 mm.; width, 15-15.5 mm.

Head: Eye not conspicuously flattened externally, external margin at anterior angle perpendicular to longitudinal axis of head, when viewing head with longitudinal axis horizontal; longitudinal sulcus mesad of each eye deep throughout its length and situated rather far from eye, being nearly halfway between eye and median line of head; eye lower than interocular space; width of eye less than one-half width of interocular distance; clypeus not prominent, head evenly arcuate from vertex to middle of clypeus; length of tylus equal to length of eye; antenna 3-segmented with a long fingerlike process on segment II (fig. 19).

Metasternum: Keeled rather strongly basally, apical half flattened, not keeled, sides reflexed upward forming a gutter mesad of apical margins.

Hemelytron: Greatest width of membrane and translucent border combined greater than median length of posterior lobe of pronotum, apex of wing broadly emarginate, not evenly rounded; embolium gradually broadening from base.

Ventral laterotergites: Dense pubescence covering only basal two-thirds of last plate, remainder covered with stout spines.

Air strap: Basal half of lobe dorsally covered with a dark tomentum, no depression, ripples or sac; posterior margin of tomentose area bordered with a narrow, slightly sinuate band of hairs (fig. 9, a).

Phallus: Opening of ejaculatory duct dorsal and nearly horizontal, lateral wing short, curved throughout its length and broadened apically (fig. 27).

Female.—Same as male except as follows: membrane broader, greatest width of membrane and translucent border combined nearly twice median length of posterior lobe of pronotum; apex of hemelytron not emarginate but evenly rounded; air strap narrower, with narrow band of hair situated farther from apex of lobe (fig. 9, b).

This species is very closely related to *indentatus*. The air straps of the two species are very similar but phallus details are diagnostic. They have widely separated ranges, *indentatus* being found in California and *stangei* known only

from Vera Cruz and Puebla, México. The phallus of *stangei* is similar to *dilatatus*, but the air straps are very different in the two species.

Champion's 1901 record of *Pedinocoris macronyx* (= *indentatus*) from México may pertain to this species (Rio Mescales, Cuesta de Misantla, and Jalapa). He recorded *macronyx* also from California. It is possible that he confused *stangei* with the similar appearing *indentatus*. Mayr (1863) also recorded *macronyx* from México, but in 1871 he reversed his statement, saying that he was in error.

Types.—Holotype male, allotype female, and 3 paratypes: Jalapa, Vera Cruz, México, Dec. 26, 1958, Arnold Menke and Lionel Stange. Holotype and allotype are deposited in the Los Angeles County Museum. Three paratypes in my collection. The specimens were collected in a small tributary stream to a river that crosses the highway about two miles west of Jalapa.

This species is dedicated to Lionel Stange, a close friend and collecting companion for many years.

Distribution (fig. 44).—In addition to the type series from Jalapa, Vera Cruz, I have seen the following metatypes: La Joya, Vera Cruz, Aug. 17, 1959, A. Menke and L. Stange, 1 ♂, 2 ♀♀ (AM); Chignaulingo, Puebla, Aug. 16, 1959, A. Menke and L. Stange, 3 ♂♂, 3 ♀♀ (AM). I have also seen a male and female metatopotype from Jalapa, Vera Cruz, Aug. 17, 1959, A. Menke and L. Stange (AM).

Abedus (*Deinostoma*) *indentatus* (Haldeman)

(Figs. 5, 7, c, 8, 44)

Zaitha indentata Haldeman, 1854, Proc. Acad. Nat. Sci. Phil., 6:364.

Pedinocoris indentata, Uhler, 1877, Ann. Rept. Geog. Surv. W. 100th Merid. App. N N, p. 1331 (listed).

Pedinocoris indentata (!), Montandon, 1902, Bul. Soc. Sci. Buc., 12(1-2):113 (listed); Banks, 1910 (in part), Cat. Nearc. Hem. Het., p. 8.

Abedus indentata (!), Kirkaldy and Bueno, 1909 (in part), Proc. Ent. Soc. Wash., 10(3-4):189 (cat.).

Abedus indentatus, Van Duzee, 1917 (in part), Cat. Hem. Amer. No. Mexico, p. 471 (cat.).

Pedinocoris macronyx Mayr, 1863, Verh. K. K. Zool.-Bot. Ges. Wien, 13:350-351 (♂) (new synonymy); Mayr, 1871, Verh. K. K. Zool.-Bot. Ges. Wien, 21:405 (listed); Uhler, 1875, Bull. U. S. Geol. Geog. Surv. Terr., 1:338 (listed); Uhler, 1886, Checkl. Hem. Het. No. Amer., p. 28 (checklist); Uhler, 1894, Proc. Calif. Acad. Sci., 2d ser., 4(1):292 (listed); Montandon, 1903, Bul. Soc. Sci. Buc., 12(1-2):113 (listed); Kirkaldy, 1906, Trans. Amer. Ent. Soc., 32(2):151 (listed); Harvey, 1907, Can. Ent., 39(1):17-21 (biol.); Banks, 1910 (in part), Cat. Nearc. Hem. Het., p. 8 (cat.).

Abedus macronyx, Kirkaldy and Bueno, 1909 (in part), Proc. Ent. Soc. Wash., 10(3-4):189 (cat.); Van Duzee, 1917 (in part), Cat. Hem. Amer. No. Mexico, p. 471 (cat.); Hungerford, 1919, Univ. Kans. Sci. Bull., 11:142-143 (biol.).

Pedinocoris brachonyx Mayr, 1863, Verh. K. K. Zool.-Bot. Ges. Wien, 13:351-353 (♀); Mayr, 1871, Verh. K. K. Zool.-Bot. Ges. Wien, 21:405 (listed); Uhler, 1875, Bull. U. S. Geol. Geog. Surv. Terr., 1:338 (listed); Uhler, 1886, Checkl. Hem. Het. No. Amer., p. 28 (checkl.); Montandon, 1903, Bul. Soc. Sci. Buc., 12(1-2):113 (listed).

Abedus hungerfordi De Carlo, 1932, Rev. Soc. Ent. Arg., 22:123-124 (♂, ♀) (new synonymy); Hidalgo, 1935 (in part), Univ. Kans. Sci. Bull., 22:505-506 (rev.); De Carlo 1938, Anal. Mus. Arg. Cienc. Nat., 39:245-246 (desc.); De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:11-13 (rev.); De Carlo, 1951, Rev. Soc. Ent. Arg., 15:71 (listed); Usinger, 1956, Aquat. Ins. Calif., p. 206 (key).

Abedus mayri De Carlo, 1948, Comun. Mus. Arg. Cienc. Nat., 5:13-14; De Carlo, 1951, Rev. Soc. Ent. Arg., 15:71 (listed); Usinger, 1956, Aquat. Ins. Calif., p. 205 (syn.).

The following citations refer at least in part to this species:

- Serphus dilatatus*, Uhler, 1875 (in part), Bull. U. S. Geol. Geog. Surv. Terr., 1:338 (listed); Uhler, 1894, Proc. Calif. Acad. Sci., 2d Ser., 4(1):292 (listed).
Abedus dilatatus, Kirkaldy and Bueno, 1909 (in part), Proc. Ent. Soc. Wash., 10(3-4):189 (cat.); Van Duzee, 1917 (in part), Cat. Hem. Amer. No. Mexico, p. 470 (cat.).
Abedus dilatatus (?), Van Duzee, 1914, Trans. San Diego Soc. Nat. Hist., 2(1):33 (listed).

Size: Length, 27-37 mm.; width, 14-20 mm.

Head: Eye somewhat flattened externally, exterior margin at anterior angle perpendicular to longitudinal axis of head or very slightly recurved, when viewing head with longitudinal axis horizontal; longitudinal sulcus mesad of each eye deep and occasionally broadened into a large depression at apical third of eye; eye as high as or slightly lower than interocular space; width of eye slightly less than one-half width of interocular distance; clypeus usually prominent, head depressed slightly before base of clypeus; length of tylus three-fourths to four-fifths length of eye; antenna 3- or 4-segmented, with a long fingerlike projection on segments II and III (figs. 5, 7, c); segment I of beak equal to or slightly less than length of segment II (unlike any other species in subgenus).

Metasternum: Keeled basally, becoming elevated at mid-point, apex medially sulcate or depressed.

Hemelytron: Greatest width of membrane and translucent border combined equal to or greater than twice median length of posterior lobe of pronotum; margin of apex of forewing rounded to broadly emarginate.

Ventral laterotergites: Last plate covered with dense pubescence only on basal three-fourths, remainder sparsely covered with short, stout spines.

Air strap: Basal half of male strap covered dorsally with a dense dark tomentose pubescence, no depression, ripples, or sac present (fig. 8); dark tomentose area bounded apically with a narrow sinuate band of long hairs; female strap similar to male but narrower.

Phallus: Opening of ejaculatory duct on downward sloping face of apex of phallus; lateral wing long and straight for basal half but curving downward in apical half; anteroventral part of phallus medianly depressed (fig. 24).

The depressions mesad of each eye on the head may be poorly or strongly developed in certain specimens. The clypeus is not prominent in all examples that I have seen. In these, the head may be more or less evenly arcuate from its vertex to the apex of the clypeus. As mentioned in the description, the antenna varies. In some specimens, the fourth segment is not fully separated from the third by a suture. The air straps of both sexes may have a less well-defined sinuate band of hairs than has been illustrated in figure 8.

This species is most closely related to *A. stangei*. Both have similar air straps, but the phallus is different in the two and will readily separate them. The tylus is less produced in front of the eyes in *indentatus* than in *stangei* and the two species are widely separated geographically. *A. indentatus* is known only from California and Baja California, and *stangei* is known only from east central México. The phallus of *A. indentatus* is nearly indistinguishable from that of *A. herberti*. The air straps of these two species are quite different, however.

Abedus brachonyx and *macronyx* were based on single specimens taken in California. Dr. Usinger in 1958 compared specimens of *indentatus* with the types in Vienna. The claws on the front tarsus of *brachonyx* are not present and apparently were never formed, according to Dr. Usinger. This is an aberrant condition. I have not seen a single *Abedus* in this condition in all the specimens I have examined. I have examined the type of *Abedus hungerfordi* through the courtesy

of Dr. H. B. Hungerford and Dr. George Byers of the University of Kansas and found that it is the same as *indentatus*. *A. mayri* De Carlo was rightly synonymized by Usinger in 1956. It is unfortunate that Haldeman's *indentatus* was overlooked or ignored by later workers. The several synonyms now assigned to this species might have been avoided if his name had been recognized.

Type.—Haldeman's material was lost or destroyed in the course of the Civil War, according to Mr. Harold Grant, Jr., of the Philadelphia Academy of Sciences. There is little doubt, however, that his species is the same as that to which I have applied his name. In his description he cites California as the source of his material, which he apparently obtained from Dr. John L. LeConte. To establish the species definitely, it is desirable to designate a neotype. Accordingly, I have selected a male specimen for neotype designation from the following locality: San Francisquito Canyon, Los Angeles County, California, April 3, 1953, A. Menke. A female neallotype and 25 neoparatypes will also be selected from the same series. The neotype and neallotype will be deposited in the Los Angeles County Museum. Neoparatypes will be distributed to as many cooperating institutions and individuals as is possible.

Distribution (fig. 44).—The range of *indentatus* is rather restricted since it occurs only in California from about 39° latitude to northern Baja California. It does not occur in Arizona, the desert in southern California apparently being an impassable barrier. No material has been seen from Nevada although it is possible that collecting will reveal its presence there. Possibly the Sierra Nevada forms a barrier to eastward migration.

Nearly 600 specimens of this species have been examined from many localities in California. For this reason only token records will be given for many counties.

Material examined.—CALIFORNIA. Alameda Co.: Berkeley, March 28, 1922, T. I. S., ♂ (UCD); Oakland, Aug. 10, 1930, ♀ (USNM). Calaveras Co.: Murphys, Dec. 1, 1956, ♀ (AM); 6 mi. N. Copperopolis, Sept. 14, 1957, A. Menke and L. Stange, ♂, ♀ (AM). Contra Costa Co.: Mount Diablo, April 22, 1931, A. McClay, ♀ (UCD); Walnut Creek, Aug. 9, 1929, R. Usinger, ♂ (UCD). Imperial Co.: Wash below Harper's Well, 5 mi. W. Kane Spring, April 18, 1938, R. Miller, 2 ♂♂, 9 ♀♀ (UMMZ). Inyo Co.: Hanaupah Canyon, Death Valley, Nov. 29, 1958, A. Menke and L. Stange, 22 ♂♂, 21 ♀♀ (AM); Surprise Canyon, Panamint Mts., April 21–24, 1957, P. Hurd and J. Powell, 15 ♂♂, 6 ♀♀ (CIS). Kern Co.: 5 mi. NE. Onyx, Sept. 11, 1957, A. Menke and L. Stange, 8 ♂♂, 5 ♀♀ (AM); Tejon Pass, May 12, 1928, ♂, ♀ (RLU). Los Angeles Co.: Claremont, Baker, 4 ♂♂, ♀ (Pomona); Frenchman Flat, April 7, 1951, R. Usinger, ♀ (RLU); Hidden Lake, Pine Canyon, Oct. 31, 1953, A. Menke and C. Gage, ♂, 2 ♀♀ (AM); Los Angeles River, March 31, 1925, L. Muchmore, 3 ♀♀ (LACM); San Francisquito Canyon, March 29–April 3, 1953, A. Menke and L. Stange, 50 ♂♂, 50 ♀♀ (neotype series) (LACM and AM); Soledad Canyon, July 15, 1956, A. Menke, 2 ♂♂, 2 ♀♀ (AM); Tanbark Flat, July 16, 1950, W. Marshall, ♂ (UCD); Tuna Canyon, Santa Monica Mts., Nov. 22, 1953, A. Menke and C. Gage, 2 ♀♀ (AM). Madera Co.: Coarsegold, May 26, 1942, W. Allen, ♂, ♀ (CIS); San Joaquin Exp. Range, March 27, 1952, H. Childs, 2 ♂♂ (CIS). Marin Co.: Lagunitas, June 4, 1911, E. Van Dyke, ♂ (RLU). Mariposa Co.: 14 mi. S. Mariposa, Aug. 17, 1940, R. Miller, ♀ (UMMZ). Monterey Co.: Salinas River, July 17, 1925, ♂ (USNM). Nevada Co.: Truckee, July, 1933, C. Norland, ♂ (LACM). Orange Co.: Harding Canyon, Aug., 1930, E. Sibert, ♂ (Hancock); San Juan Creek near San Juan Capistrano, Oct. 11, 1954, F. Truxal and L. Martin, ♂, 4 ♀♀ (LACM); Santa Ana, June 12, 1938, E. Herald, ♀ (CAS). Placer Co.: Lake Tahoe, July 3, 1950, R. Goodwin, ♀ (CIS). Riverside Co.: Herkey Creek, Nov. 5, 1939, R. Miller, ♀ (UMMZ); Palm Springs, Oct., 1902, Hubbard, ♂ (USNM); Riverside, Dec. 1, 1935, C. Dammers, ♂ (LACM); Temecula, July 19, 1930, J. Hornung, ♂ (LACM); Whitewater Canyon, April 2, 1948, J. MacSwain, ♂ (RLU). Sacramento Co.: Sacra-

mento, March 26, 1949, R. Bechtel, ♂, ♀ (UCD). San Bernardino Co.: Barton Flats, July 22-26, 1953, L. Stange, 3 ♂♂, 2 ♀♀ (LACM); Cajon, June 30, 1953, B. Malkin, ♂, ♀ (UK); Deep Creek Public Camp, June 15, 1957, A. Menke and L. Stange, 4 ♂♂, 10 ♀♀ (AM); Mojave River at spring fed tributary, Victorville, April 30, 1955, Miller and Hubbs, ♀ (UMMZ); Saratoga Springs, Death Valley, Jan. 10, 1955, F. Truxal, ♀ (LACM). San Diego Co.: Boulevard, July 22, 1941, B. Hodgden, ♀ (UK); Campo, July 18, 1940, L. Kuitert, ♀ (UK); Fallbrook, May 8, 1948, W. Jones, ♂ (CIS); Jacumba, July 17, 1940, L. Kuitert, 5 ♂♂, 6 ♀♀ (UK); Mission Gorge, Jan. 21, 1948, G. Marsh, ♀ (CIS); Palm Canyon, San Ysidro Mts., June 14, 1958, L. Stange, ♀ (AM); San Diego, June 27, 1890, P. Uhler, ♀ (USNM); Sentenae Canyon, Jan. 23, 1956, A. Menke and L. Stange, ♀ (AM); Vallecitos, Oct. 13, 1954, F. Truxal and L. Martin, 2 ♀♀ (LACM); Viejas River, Alpine, Oct. 13, 1954, F. Truxal and L. Martin, ♂, ♀ (LACM). San Francisco Co.: South San Francisco, April 15, 1922, C. Fox, 2 ♂♂ (CAS). San Luis Obispo Co.: Paso Robles, Sept. 15, 1928, L. Slevin, 2 ♂♂, ♀ (CAS); 1 mi. N. San Luis Obispo, June 19, 1939, R. Miller, ♀ (UMMZ). San Mateo Co.: Menlo Park, J. Hornung, ♀ (LACM); Rockaway Beach, March 10, 1931, ♂ (RLU); San Bruno, April 16, 1923, C. Fox, 2 ♂♂ (CAS). Santa Barbara Co.: Salsepuedes Creek and El Jaro Creek nr. Lompa (Lompoc?), May 18, 1940, R. Miller, ♂ (UMMZ). Santa Clara Co.: Almaden, April 30, 1930, 2 ♂♂ (UCD); Llagas Creek, Oct. 15, 1922, C. Hubbs, 9 ♂♂, 13 ♀♀ (UMMZ); San Jose, Sept. 30, 1922, C. Hubbs, ♀ (UMMZ). Santa Cruz Co.: Soquel, July, 1933, C. Hamsher, 2 ♂♂, ♀ (UCD); Watsonville, April 7, 1892, G. Harvey, ♀ (USNM). Solano Co.: Vallejo, June 8, 1915, ♂ (RLU). Sonoma Co.: May 7, P. Bomberger, ♂ (CAS). Stanislaus Co.: Knights Ferry, Feb. 8, 1926, C. Whitmore, ♀ (CAS); Patterson, Sept. 13, 1951, W. Middlekauff, ♂ (RLU); Turlock, April 6, 1953, R. Snelling, ♀ (UK). Tulare Co.: Kaweah, May 27, 1919, R. Hopping, ♀ (CAS); Poso Creek near Posey, Sept. 11, 1957, A. Menke and L. Stange, ♂ (AM); Three Rivers, Oct. 31, 1922, E. Van Duzee, ♂ (CAS). Tuolumne Co.: Green Spring Run, tributary to Stanislaus River, 13 mi. E. Knights Ferry, Aug. 18, 1940, R. Miller, ♀ (UMMZ). Ventura Co.: Sespe Canyon, Oct. 27, 1957, R. Erdman, ♂ (AM). Yolo Co.: Davis, Sept. 26, 1936, B. Hosman, ♂ (AM).

MEXICO. BAJA CALIFORNIA: Arroyo Santo Tomás, Nov. 30, 1957, E. Sleeper, 3 ♀♀ (ELS); foot of Canto Grande, April 21, 1951, ♂ (SDM); Canyon near Caskills Tanks, Nov. 15, 1936, C. Harbison, ♂, ♀ (SDM); El Tajo Canyon, Sierra Juarez Mts., Sept. 13-14, 1958, F. Truxal and J. Northern, 11 ♂♂, 17 ♀♀ (LACM); 17 mi. S. Ensenada, June 14, 1938, Michelbacher and Ross, 4 ♂♂, 8 ♀♀ (CAS); Guadalupe Canyon, Sierra Juarez Mts., July 6, 1955, R. Orr and C. Tose, ♂ (CAS); 8 mi. from mouth of Rio San Isidro, June 30, 1946, C. Hubbs, ♂ (Hancock); San Fernando, July 31, 1938, Michelbacher and Ross, ♂ (CAS); 20 mi. S. Santo Tomás, Aug. 3, 1938, Michelbacher and Ross, 2 ♀♀ (CAS); 45 kms. S. Tijuana, Aug. 21, 1953, L. Stange, ♀ (LACM).

SUMMARY

In this, the third revision of the genus *Abedus* within the last 25 years, ten species are recognized and three of these are new to science. The new species are *Abedus decarloi* from Nayarit, México; *immensus* from west-central México; and *stangei* from Vera Cruz and Puebla, México. The following new synonymy is proposed: *Abedus usingeri* De Carlo = *A. signoreti vicinus* Mayr; *A. anconai* De Carlo and *A. montandoni* De Carlo = *A. dilatatus* (Say); *A. drakei* De Carlo and *A. stali* De Carlo = *A. herberti herberti* Hidalgo; *A. macronyx* (Mayr) and *A. hungerfordi* De Carlo = *A. indentatus* (Haldeman).

Notes on the biology of *Abedus* are presented including information of the habitat, life history, and parasites and commensals. A summary of the past taxonomic history of the genus is included with a detailed account of the breakdown of the genus into subgenera. Species characters used past and present are evaluated. A key to the belostomatid genera occurring in the Western Hemisphere is presented together with a key to the species of the genus *Abedus*. Complete distributional and synonymical data are given for each species. Lectotypes are des-

ignated for *Abedus breviceps* Stål, *ovatus* Stål, *signoreti signoreti* Mayr, and *signoreti vicinus* Mayr. Neotypes are erected for *A. dilatatus* (Say) and *indentatus* (Haldeman).

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PLATES



Dorsal view of a male *A. herberti* s.s., showing egg mass.



Dorsal view of a male *A. dilatatus*.



Dorsal view of a female *A. dilatatus*.